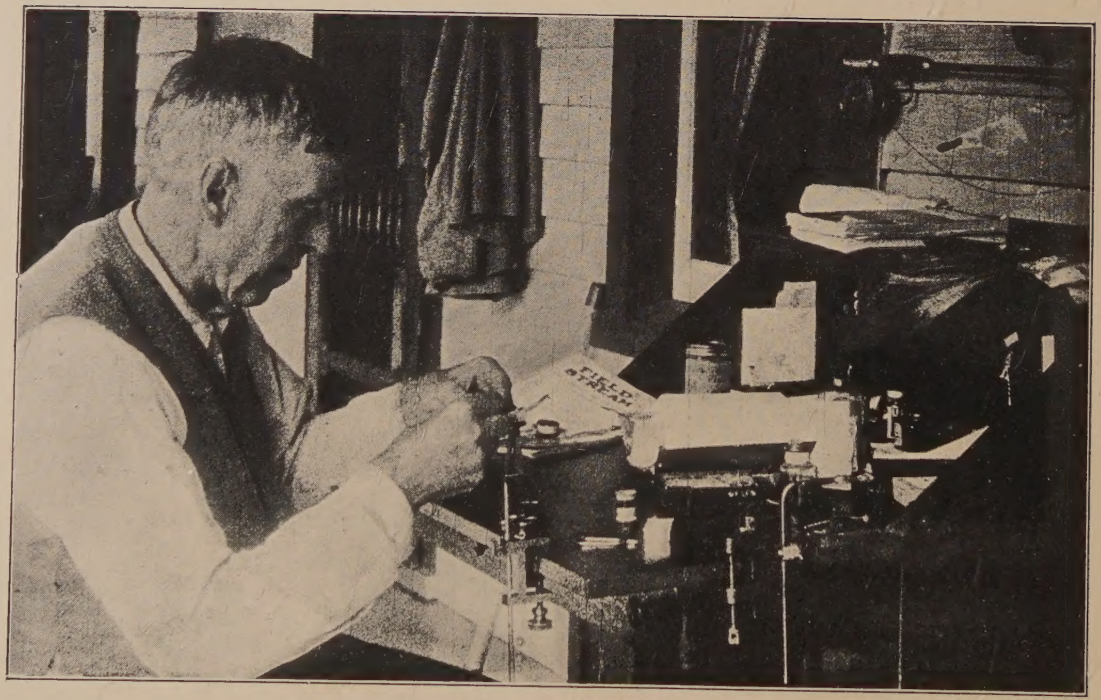
TELLING ON THE TROUT



THE AUTHOR TYING FLIES.

TELLING ON THE TROUT

EDWARD RINGWOOD HEWITT

"AUTHOR OF SECRETS OF THE SALMON"

With Illustrations from Photographs and Drawings by the Author

NEW AND REVISED EDITION

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PREFACE

It is now some fifty years since I began to try conclusions with the trout; many of my fellow anglers have swapped theories and experiences with me on many a brook and from these talks has come this little book—not a manual of trout fishing but the answer my study and experience give to some questions that linger with the tried and true fisherman.

Aspects of trout fishing that have been excellently treated by others I have not touched. I have briefly mentioned my observations in the "Secrets of the Salmon" on the fly as seen by the fish. The chapter (equally applicable to trout fishing) on casting and the holding power of rods and leaders has been put in in substance in an abridged form.

To take trout from the stream under difficult aspects of water and weather is the study of the sportsman. I here offer to my brothers of the rod and reel what I have learned from half a century of faithful devotion to the sport.

E. R. HEWITT.

"The rocks where the water just bubbles
And eddies by in a spume
With the foam whirling round the corners
And the flies piling up in the turn:

"The lunch and the fire which made it,
Under the big birch tree
Near the spring with its croaking bullfrog
And the bank with the buzzing bees;

"Surely luck was with me to-day, Sir,
I left my heart in the stream,
My body is weary to-night, Sir,
But I have lived the stuff of my dreams."

E. R. Hewitt.

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TELLING ON THE TROUT

CHAPTER I

HABITS OF THE TROUT

Trout fishing being a sport of such endless variety it is naturally difficult to give an account of all the various fishing methods employed to obtain the best sport. The waters vary from the little meadow or woodland brook, a few feet wide in places, up to large rivers and lakes, and the water from still pools to rushing torrents, from crystal clearness to muddy freshets. Trout can be taken by the skilful angler under all these conditions, and for each stage of the water or kind of stream there is an appropriate method of fishing. My conception of a good fisherman is one who can adapt himself to any conditions and catch trout no matter how hard they may be to take. It may be necessary to use a dry fly, a wet fly, or even bait. All methods require skill to do them well. As great skill can be displayed in bait fishing as can ever be shown in fly fishing, both in the casting and in knowing where and how to

place the bait. Naturally we all prefer fly fishing, because of the pleasure of casting and the feeling of fooling our quarry. I rarely use bait; the fly manipulated properly is nearly always more effective than any bait for trout, although at times this is not the case, as the following instance will illustrate.

At Neuman's Sound, in Newfoundland, a stream comes in to the head of the bay over a sandy bottom, which is almost the level of the bay for a mile or so. As the tide rises and falls in the bay it backs the water up in the stream, and the stream becomes deeper or shallower. When we were there a large school of trout, of about three to three and a half pounds in weight each, had the habit of coming in with the flood-tide and moving up to a pool about three feet deep, and resting in plain sight on the bottom, in the centre of the pool. No kind of wet or dry fly would cause them to rise. Two hours of hard casting proved absolutely ineffectual. A piece of trout belly with the fin on pulled through the water failed to tempt any of them. Finally I tried letting the trout belly rest on

the sand a few minutes and then pulled it away. A fish at once made a dart and was landed easily. After that we took all the trout we wanted on each tide, and we failed to get them in any other way.

I am not one of those who hold up their hands in holy horror at bait fishing when it is necessary to get fish by this method. I do it occasionally, and try to do it as skilfully as possible.

Still another instance of conditions when it was impossible to take large trout with a fly might be cited.

One spring, early in May, a party of friends and I went up to the Triton Club, in Quebec, to see if we could get any of the very large trout which were reported to be in Batiscan Lake and the waters near it. We camped at the outlet of the lake and fished assiduously for several days. No one caught any trout over a pound or two, and we saw none, and began to feel that the large trout were a myth, as this was the very best trout-fishing season in the year.

One afternoon after lunch Warren God-

dard and I decided to hold an informal casting tournament from a big, square rock in the centre of the stream beside the camp. After a few casts I hooked a small five-inch trout on a fly, and having out a very long line, laid the rod down on the rock and pulled the line in by hand to unhook the fish. As he came close to the side of the rock I noticed a shadow move deep down in the clear water. The small trout was dead, so I cut him in three pieces and hooked the centre piece through the back fin and lowered it beside the rock. In a moment I felt something, gave a jerk, and was fast to a fish. I then stood up and wound in the line and played the fish from the rock. Goddard wanted to know what I was up to. I replied that I was just playing a little fish, but we had better get into the canoe. After a good fight the trout was landed on the beach—a fish of six and a half pounds. Goddard was all excitement and wanted to see if there were any more. He caught another five-pound one below the same rock, and three more very large fish were taken near other rocks in the stream.

When we got back to the camp the others wanted to know how we had gotten these fish, and Goddard replied that it was with silver doctors, a little below the surface. The others thrashed the river up and down with silver doctors until dark, and failed, of course, to raise a single trout. The next day the secret was out and all got some large fish.

I believe it was absolutely impossible to raise any of these large trout on a fly at that time, and if we had not used bait our whole trip would have been in vain.

CHAPTER II

BEHAVIOR OF BROOK TROUT AND BROWN TROUT IN THE STREAM

A KNOWLEDGE of the habits of brook trout and brown trout is essential to a fisherman in order that he may know what to expect on the stream at different times of the year and in various kinds of water.

The brook trout seems to have acquired the habit of getting behind obstacles in the current, and you will often catch him behind a stone or a log, or some other obstruction. The brown trout, however, behaves quite otherwise. While he is at times found behind obstacles, when he is really feeding or taking flies he is almost always in front of a stone where the current divides to pass around it, or he is at the side of the stone or log just out of the current. In this way he can see the fly farther ahead up the stream than the brook trout. The brown trout also has the habit of locating at the back edge of a stony pocket just where the water flows out. He

will always select by preference a pocket with a swift stream at the back, preferably with fairly deep water of a foot or more, next to the outlet. This is absolutely true of large fish. They do this because the water flowing out over this sharp edge leaves a pocket below in which there is no current, and in which the water is perfectly still. The fish does not have to swim when lying in this pocket and can get a good start and catch anything coming down on the surface of the water. The trick in taking trout in these places is to keep the leader entirely out of the water, and only allow the fly to float on top. This can easily be done by using a short line and standing fairly close to the pocket, as the fish being under the sharp edge cannot see the fisherman.

A fly cast in this way will seem to linger on the lip of the pool, and give the fish time to come up and take it. When you strike the fish is pulled out over the lip of the pool.

This kind of fishing is particularly enjoyable as it involves a special degree of skill, and is quite exciting. I know a number of

streams which must be fished in this way to get such fish, and there is really no other method of catching them. It is perhaps because of the difficulty of this type of fishing that these fish are not caught and remain in these places. When a fair-sized brown trout is hooked he should not be held tight but should be allowed to run free. It is the first run which generally smashes the light tackle for the novice. After the first run the brown trout is usually easily handled unless he has a pet hiding-place where he is in the habit of going. I remember once hooking a pound fish and having him dart across the pool into a muskrat hole in the far bank. He went in about six feet. I sat down on the other bank and waited. In a little while the fish turned around and came out as I kept a continual strain on him. I never could see how he could turn around in such a small hole. If he had been pulled hard the fine leader would certainly have parted.

Sometimes fish run under flat rocks and cut the leader, or they may run under a rock and come out the other side, leaving the

leader fast, passing under the stone. Once when this happened to me the stone was too large for me to wade in and turn over, and the water was too deep. All I could do was to feed out line and keep up a gentle strain and wait. The fish slowly returned to the stone and swam through the hole again, freeing the leader. On another occasion luck might not be so good, but this same thing has happened a number of times. If the strain on the fish is kept very light there is always a chance of saving the fish if the fisherman does not get excited. This is perhaps most of the fun. One day fishing on the Willowemoc, my friend Mack Allen came to the place where I was, in great excitement, saying that he had raised a large brown trout on a fly and not touched him. He was so excited he was afraid to try again, being a very nervous small man. He wanted me to come down and get the fish. I urged him very strongly to go back and get the trout, but he refused, and said he would only lose it and his tackle as well. At the head of a long straight run with the water against the bank the trout was

raised and hooked. He at once ran down the stream at express speed for 150 feet. As there was only thirty yards of line on my reel I had to run to keep up with him, but he soon turned and was easily landed on the gravel bar. This was a fish of three pounds, and Mac assured me he would certainly have let him break his tackle, as he never would have expected a run of this length at such a speed. A good-sized fish hooked in this long, straight gravel run, with no hiding-place, was almost certain to run as fast as possible to the deeper part of the pool where he is accustomed to hiding.

This is one of the instances where salmon fishing is such a good education in handling trout. There is one stream in which I fish regularly every spring in which there is an old kitchen stove thrown out in the brook with the covers off and the oven door open. On several occasions I have cast over this stove, which is about a foot below the water, and had a trout come out of the oven and take a fly and attempt to hide in some of the cover-holes and cut the leader. Maybe they

are only practising for cooking later on, but this is a particularly difficult place to catch a brown trout.

The migration of trout in our Eastern streams deserves more consideration than it gets. Both brook trout and brown trout migrate up and down stream, and a knowledge of their movements is likely to prove most valuable to the angler. Of course, the degree of migration, and the time when it takes place must depend very greatly on the character of the stream itself, but in the Eastern streams of the United States I do not know any where the trout do not move up and down stream during the various times of the year. The brown trout seems to be a much greater traveller than the brook trout, and this is particularly true of the larger fish of over three pounds in weight. These fish, when they finish spawning in the autumn, seek the deepest pools in the stream for winter quarters, as in these deep pools they are secure from freshets and ice, and though trout feed very little when the temperature of the water is thirty-eight degrees or below, as soon as the

water reaches forty degrees they are likely to find more food in the larger pools. Of course, usually the deeper pools are where the stream is larger, and therefore the larger fish, for the most part, retire to the larger waters of the stream for winter quarters. As the advancing spring warms up the water they make their way up-stream, following the successive hatches of insects and other food. The fish of three-quarters of a pound to a pound and a quarter usually travel faster and earlier than the larger fish, in my experience. In the Willowemoc and Beaverkill these larger fish begin to move up early in May, from the 1st to the 15th or 20th, and it is then that the best fishing occurs. The same thing happens in the Neversink, but usually about a week later than in the former streams.

The run of fish lasts until the water begins to get hot, about July 1st, when on my stretch of water on the Neversink most of the fish are in the upper reaches of the stream. I have often noticed a school of these fish extending for a quarter of a mile or so along the river. On the next day they would al-

ways be a little farther up-stream, the fish travelling as much as a half mile in one night. It seems very like the movement of salmon, on a small scale. On the Broadhead I noticed a bunch of large brook trout for several years. They always moved up the stream about the same time of year, and at about the same rate. There appeared to be about two or three dozen of these larger fish. I never found any of them above a certain small brook entering the river, so that I was interested to see what there was in the smaller brook, and whether they did not go there. It passed through a large swamp and there proved to be some large still spring holes in a swamp where these fish spent the hot weather until spawning time. After spawning they evidently moved down the river for winter quarters.

On the Analomink at Henryville, Pa., there is a dam which trout could get over only in very high water. Below the dam at one side was a deep pocket, about eight feet across, with a hiding-place under a log cribbing. Mr. Henry employed a Polish gardener who used to fish with bait in this hole every night, and

he did this for many years during the trout season. He told me that he never caught any large brown trout until about June 20th, but from that time until August 15th, the end of the season, he always caught one, and sometimes two, every night. One season he took eighty fish in this way of over one and a half pounds in weight. These fish were coming up-stream every night from the larger pools below. The small hole below the dam would not have accommodated more than one or two at a time. Another year he took fifty-five large fish, and the next season fifty-seven. These trout ran from two to four and a half pounds each.

It looks as if this were conclusive evidence of the continual movements of the large fish through the season. A number of other instances of similar movements of trout could be given. Of course, we all know pools and hiding-places where the same fish seems to stop permanently, and we know that during the first spring fishing quite a number of fish are always taken all along the line of the stream. These fish have evidently wintered

in the pools. When these trout are gone it is often many days or weeks until more are caught in these pools. They must come in from the larger pools below, which are not so easily fished out in the early spring fishing.

This is a very fortunate provision of nature in favor of the angler, because if the fish lived at one point they would all be caught out at times when the fishing was very good in the early season and the fish very hungry, and there would be nothing left for fly fishermen later in the year.

The brown trout has one peculiar habit in our Eastern brooks which I have observed several times but have never yet found another angler who has seen it. Brook trout can stand a water temperature up to seventy degrees, but at seventy-two degrees, if continued for any length of time, he dies. The brown trout can stand from seventy-six to seventy-eight Fahr. over a long period before he dies, but he does not like it and will make every effort to find a cooler place. I was digging for helgramites and crawfish for black bass bait in our stream at Ringwood, turn-

ing over stones and looking under them. After several stones had been turned over and the gravel scraped I saw a fish's fin protruding from the gravel. Digging around it, very soon a brown trout appeared, of about one and a quarter pounds in weight; he had buried himself in the gravel in order to keep a little cooler. He was down about six inches in the gravel and stones, and was alive and in good condition. At that time the surface water was about seventy-five degrees Fahr. and no fish could be seen in the stream. The stones were slightly moss-covered, so that the fish had not been covered in by a freshet, as the stones had not been turned over, but he had managed to worm himself through the cracks and down into the cooler gravel. On three occasions I have found brown trout buried in the gravel in this way during the warm weather in August. I am sure that brook trout under like conditions would have perished.

CHAPTER III

FISHING IN HIGH WATER

VERY often when one goes off for a trout fishing-trip a storm occurs, the streams rise and become cloudy or muddy. When one has made up his mind to a day or two of fly fishing this is a great disappointment, as ordinary fly fishing under these conditions would be quite hopeless. Years ago I always took to bait fishing when the streams were in freshet, as I did not know any other method of having any sport. Of course, under these conditions trout feed ravenously and are out looking for all kinds of food washed into the stream. This is the time when the countryman with his coarse tackle and bait reaps a harvest and often the only time when he can catch many good-sized trout.

A number of years ago I discovered that it was not necessary to use bait to catch trout under these conditions, and that it could be done as well with a fly. Thunder-storms often occur in the Neversink Valley where my camp

is located, and the stream rapidly rises and often becomes quite muddy. In fact, it frequently rises two feet in an hour. One day after a heavy rain I crossed the large pool below the camp at the lower end and fished from the East bank, because the wading on that side is better. During the time of fishing the length of this one pool, which is about one hundred yards long, the river rose more than two feet, so that when it came to crossing at the tail of the pool, instead of easy wading I found a rushing torrent. The nearest bridge is more than two miles below. Fortunately, I had on heavy salmon waders which reached up under my armpits and, tying up the draw string very tight and getting into the pool as far toward the upper end as I dared, I ran across the current. If I could make the opposite bank before the swift water was reached it was all right; if not, I would only be rolled around a little in the rapids before I reached the other shore, anyway, but fortunately I got across with only a little wetting. I was fishing with two wet flies, rather large in size, about No. 6, similar

THE NEVERSINK IN JUNE.

to salmon flies and a little lead about the head of the lower fly. Twelve fish were landed going down over this pool once, all of them a fair size.

The fishing of this kind is done exactly like salmon fishing, the line cast across the current and allowed to swing around slowly. When the end of the swing is reached the flies are slowly pulled up in the current two or three times. This particular pool happens to be wide and still, and not over three or four feet deep. The pool above this is a rock pool where the current rushes against the ledge of rock and runs down along it. I have never succeeded in catching any trout along the rocks or in the main current when the water is high. They do not like to swim hard in high water and seek out the stiller quieter places. When the water rises in this pool the fish are taken under the willows which are on the gravel bar and do not come to the water under ordinary conditions. If the water rises still higher the trout are caught out in the grass of the meadow. This particular pool has a rather still tail even in high water, so

that by swinging a sunken wet fly across the tail I always get a number of trout on every freshet. It is easily understood that the trout cannot see their food in the swift water as easily as they can where the water runs more slowly, especially when the water is cloudy or muddy, it is very evident that they do not stay in the swift water if there is any quiet place where they can rest and have the food float to them at a rate at which they can see it.

Bearing these facts in mind, it is easy for any one to pick out the places along the stream where trout will bite in high water, and it is usually perfectly useless to fish a stream at the usual places where you get trout at the regular stage of the water. In recent years I have had great sport in high-water fishing with a wet fly, and have enjoyed it because it is quite different from regular fly fishing, and requires a peculiar knowledge of currents and of places where the food will flow most slowly and the trout rest most easily. Of course, every angler knows that when a stream begins to rise the trout come out of their

hiding-places and begin to feed ravenously. Before the current becomes too swift they may be caught in any part of the stream. The best way to get them is to fish with a wet fly and to cover all the water. As the water rises and the current increases the trout will gradually find their way to the stiller places, unless they have already become gorged with food. If they have taken all they can hold they will go under the rocks and get out of the current, and it is impossible to catch them until they have digested their meal.

It is not wise to be discouraged at the appearance of the stream until the fisherman has carefully tried whether or not he has just as good fishing as he would have in ordinary water. I, myself, have often been surprised at how many fish could be caught under conditions which, to the ordinary angler, would seem impossible for fly fishing. Mr. La Branche was spending a week-end with me a couple of years ago when one of these storms struck the Neversink. The river was up over two feet and we sat around

the fire swapping fishing yarns all the morning. Finally, after lunch, I said I was going down to the river to get some trout for supper and every one laughed at me. La Branche said he would sit on the porch and watch, and if I caught anything he would come down.

The pool in front of the camp is visible from the porch. I was fishing with two wet flies. On the second cast two fish rose at once, of fair size, and they both splashed when they got to the surface. The two splashes were directly in line with the view of the camp and La Branche thought I had a whale. The next thing I noticed as I turned around was La Branche coming across the meadow carrying a rod and waders and running like a deer. We easily got six or eight fish, which was all we wanted for the house, and had quite a lot of fun, whereas otherwise we would have spent all the afternoon without any sport whatever.

On one of my visits to my old friend Mr. Roof, who owned the best of the water on the left branch of the Neversink, it occurred to me that if there were any large brown trout

in the pools it would be very likely that some of them might remain out of their hiding-places after sunrise, following their night's feeding, and if so there might be a chance to get one on a fly.

One sunrise found me on a stretch of water below a large pool, where a low dam had been built to make the pool a little deeper. This dam furnished a good hiding-place, and was sure to hold a big fish, because I had noticed that there were almost no smaller trout near it or in the pool below. This is generally a sure sign of the presence of a large trout. He has either eaten or scared away all the smaller fish.

Entering the stream about a hundred yards below the dam I worked my way carefully upstream, looking everywhere for any signs of a large fish. Ahead there was a gravel stretch of water, about six inches deep and perhaps forty feet wide and a hundred feet long, with a fair current in it. A little to one side of the centre I noticed a black patch which appeared like a sunken piece of wood, but soon it became evident that it was a large trout work-

its fins slowly in the current. The water was so clear and shallow that I felt sure that a fly cast near this trout or over him would simply result in his rushing up to the dam. After a few moments' consideration, I made up my mind that the only chance of getting this fish was to cast the line and leader well over to the side of the stream and put the fly a little nearer the fish, if possible. He might see it and swim over and take it. The first cast was too far away, and gradually the casts were brought over so that the fly came nearer and nearer. At last, when the fly floated down about four feet to one side of the trout he slowly swam over and deliberately opened his mouth and sucked it in. When he felt the fly strike home and the line go taut he made for the dam 150 feet away, but it was a strong current to swim against and there was a good chance to turn him before he reached the pool below the dam, where he could easily have gone under the logs. I ran as fast as I could and finally headed him off and landed him ashore on a little bar and fell on him. He was a fish of three and a half

pounds; this is a large one for this stream. The thing which interested me was the confirmation of what I already knew, that quite often these large fish can be taken in this way just after sunrise. This particular brown trout had a six-inch brook trout in his throat, and was waiting until he got it in his stomach properly before going to his hiding-place in the dam.

Exactly the same thing occurred to my friend, George Dart, at Lackawack on the Rundout Creek. We went out together below the dam just at sunrise and he spotted a big fish in shallow water and got him in nearly the same way that I did mine in the Neversink. This fish, however, weighed four and a quarter pounds. These larger fish usually remain in hiding all day in our Eastern streams and generally come out about an hour after the sun goes below the horizon, sometimes even before it is dark or too dark to see well. They generally cruise about the pool, looking for food, but they always come to the tail in the shallow water. I have taken many good fish by waiting for just this mo-

ment, remaining motionless in the centre of the stream below the tail of the pool and casting up into the shallow water as evening came on; but I do not enjoy late night fishing and feel that it should not be done.

It seems to me a legitimate thing to fish one pool this way just at dusk, as I love to see the colors change and take on the blue haze of evening, and the insects come out, and hear the night noises begin.

CHAPTER IV

HIDDEN FISH

Most of the foregoing descriptions apply to fish rising and to times when there are enough insects on the water to furnish considerable food. In our American streams there is quite a long time at the end of the season when the water gets very low and there are very few insects. At this time a fisherman may spend a whole day on the stream and not see a fish rise naturally, and yet it is then that some of the best and most enjoyable trout fishing takes place. The trout are hidden under the stones, banks, roots, or ledges, and are rarely seen in the open water. They are feeding largely at night and are usually working up into the smaller and cooler streams preliminary to spawning. These fish will take a fly if it is well handled but will refuse any poorly made cast. It is often necessary to make the same cast by the same hiding-place a great number of times to get their attention. Mr. La Branche calls this creating

a hatch of flies. That is, the fly passes so often that the fish receives the impression of a continual flow of insects and feels that the good spring feeding times have come again and he comes out to feed. I am sure there is something in this idea as I have frequently taken fish after more than forty casts past the place where I knew there was one concealed. The great difficulty is in avoiding making a bad, bungling cast in all this number, as this would certainly end any chance of getting the fish. Last year I happened upon a small, cold, rocky stream late in August. I had asked if there were any fish there and had been told that the water was too low, that there were plenty of fish there in the spring, but none at this time of the year. In the first pool I got three good fish of about three quarters of a pound and from then on I caught them as long as I stayed on the stream. There were trout in all the good hiding-places and yet I never saw a single fish in the open water. Some of these fish, even the larger ones, were in very shallow water, not over two to four inches in depth,

but always where there was a good hiding-place.

As there were very few minnows or small fish in this stream, it occurred to me that very probably there was a large hatch of night insects, and perhaps millers alighting on the water after dark. Such conditions are not at all uncommon in the late season. I know many places where excellent fishing can be had after all the ordinary fishing has passed.

The brown trout in our streams seem to vary their methods of feeding as they grow. The young trout up to about three quarters of a pound seem to feed almost entirely on insect food, very small minnows and young suckers. These fish are easily taken on a fly at almost any time but fish larger than this change their diet and while they occasionally take some insect food, particularly when the hatch of large flies is on, the bulk of their food consists of minnows, small fish, crayfish, and helgramites, which they get close to the stone at the bottom. I have even known them to take frogs when they can get them or mice or even small squirrels.

This change in their diet corresponds to a change in the size of their teeth and the structure of their mouths. Their teeth become much larger and sharper than in the smaller fish. Food of this character is much more easily obtained in larger quantities at night, so that the larger fish soon become night feeders, and are rarely taken during the day in our American streams. Large fish are, however, often caught on large flies at night. Such fishing may be done anywhere in the pool, but it seems to me that they are more likely to rise at the lower end of pools. Perhaps this is because the moths and other insects which have fallen on the pool float slowly over the shallow water of the tail and are easily seen.

CHAPTER V

VISION OF THE TROUT

In "The Secrets of the Salmon" a chapter is devoted to what the fish sees. This embodied about all I knew and had observed up to that time. Since then, however, some doubts have arisen in my mind as to whether the optical diagram reproduced on page 34, which describes the direction of the beam of light passing down and up from the water, strictly represents what actually takes place in fishing. Not that I question the accuracy of the physical measurements represented by this diagram, but this theory does not take into account the visibility due to those rays, visibility being concerned with the actual amount of light as well as with its physical presence.

In order to see for myself the actual passage of the light ray in both directions into and out of the water, or from the fisherman to the fish, and from the fish to the fisherman,

a small celluloid tank was made, one inch thick and about five inches in diameter, mounted on a graduated celluloid circle, and a small beam of light passed down into the

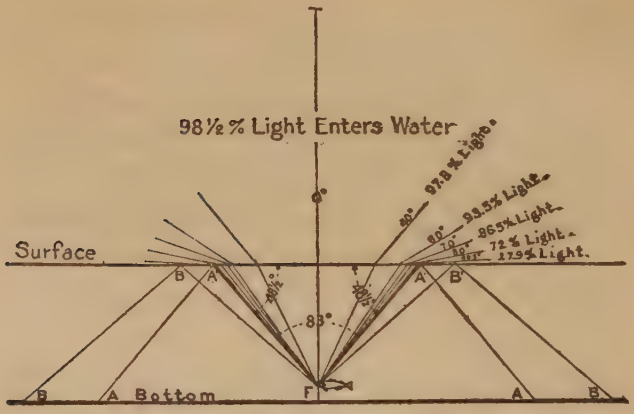


Diagram of fishes' window. Lines F-A-B show light from the fish.

water and up from the water, and the results noted by actual photographs. The beam of light was from an arc lamp, and was made parallel by a lens and passed through two small slits, twenty-four inches apart, so as to minimize the dispersion and make a sharper beam of small diameter.

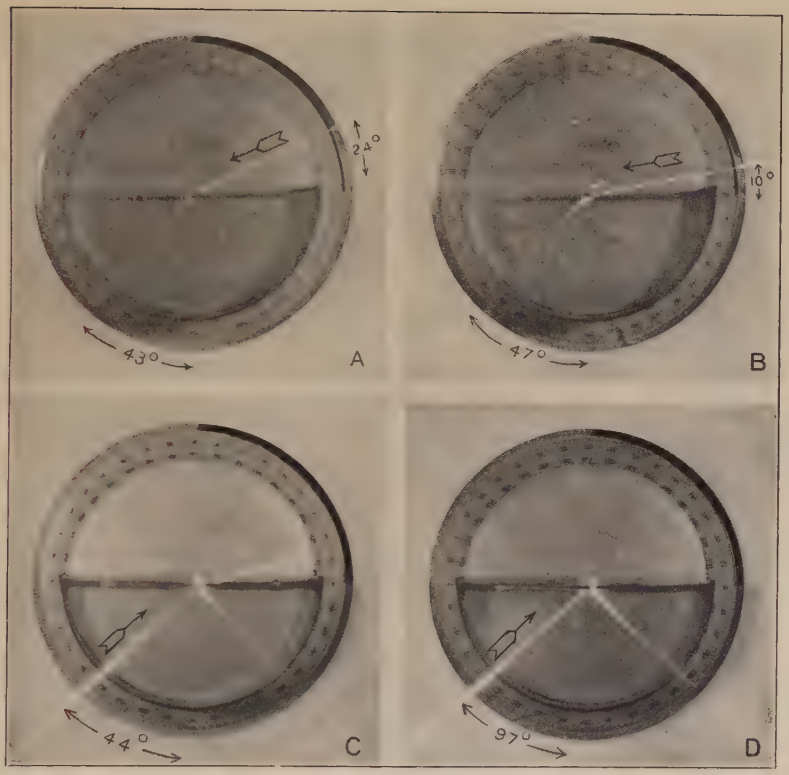
Exposure was first made of the beam which is seen reflected from an aluminum-painted background. The second exposure of the same plate was made to show the tank when it had been illuminated with other lights. Figures *A* and *B* show the beam passing down into the water from the fisherman. The angle of the beam in the water to the vertical is forty-three degrees and forty-seven degrees. In both these cases the whole beam passes into the water, only a minute amount being reflected from the surface, which was not enough to show in the photograph.

Figures *C* and *D* show the beam passing up out of the water into the air, or from the fish to the fisherman. When the angle to the vertical is forty-four degrees the beam on reaching the surface of the water is split, and part of it is reflected back into the water, and only part of it reaches the air and the fisherman. When the angle is forty-seven degrees the beam is totally reflected, and none of it gets out into the air, and no light can reach the fisherman from the fish. In the optical diagram this is shown to be on an angle of forty-

eight and one-half degrees. This is probably the absolute point of total reflection when the light is completely reflected. Perhaps under my conditions a small amount of light may have passed out, which does not show in the photograph.

These pictures indicate that at the limiting angle of vision the fish can see the fisherman when the fisherman cannot possibly see the fish, and to my mind explains many cases where I have seen trout run when I could not see them before they started. As a matter of fact the trout can see the fisherman in every position even when he is almost level with the water. This does not mean, however, that the trout always has the advantage of the angler. Here as elsewhere intelligence always finds a way to get the best of a situation.

The eyes of the fish are independent of each other, and each sees the image in its own field of vision. These eyes are not protected by lids or lashes as ours are from excessive light, and the pupil has only a small adjustment compared with ours. It is therefore



TANK OF WATER SHOWING THE BEHAVIOR OF A BEAM OF LIGHT PASSING INTO AND OUT OF THE WATER.

evident that light must blind the fishes' eyes just as it would ours if we were obliged to keep them wide open under intense light conditions. As the eye of the fish is designed to see well with very little light, especially at night, it is altogether probable that their eyes are more easily blinded than ours by excessive light. It is not likely that the sensitive retina of the fish has any wider range of resistance to light than those of higher animals; however, this is only a matter of speculation, but I believe it to be the fact. In very bright lights the fish is probably largely blinded and can see little outside of the water.

Suppose, for instance, that we are on a stream with the sun streaming across from one side and the trout is in full sunlight. Should the fisherman approach along the bank on the side from which the sunlight comes, he could not be seen by the trout, but should he come on the other side where the light fell on him, and the eye of the fish was in shadow, he would be readily visible to the trout because the eye on that side is not blinded by excessive light. The same reasoning applies

to the vision of the fly by the fish. If it passes on the sunny side the fish cannot see it, but if it passes on the side where the fish's eye is not blinded by the light, he can see it clearly and is likely to take it.

We all know how fishing improves at once with a cloud over the sun, or it may be good in the shade or bad in a bright light, and of course we all look forward to the failing light of evening for the best fishing of the day. Is this because there is more food at that time, or because the trout can see better then, and come out with a certainty of getting their food? Light conditions are probably a far more important factor in fishing than most of us recognize, and are worth a serious study. Perhaps when we take a difficult fish with rather coarse leader, it is when the leader passes the trout on the side where his eye is blinded by the light, and the fly itself just happens to come at the edge of the vision of the shaded eye, so that he sees the fly and not enough of the leader to alarm him. I have often seen fish taken which all my experience would indicate should not rise to

the tackle presented to them, and I have often sought for the explanation. This seems to me to offer a sensible solution, and it is based on sound physiological principles.

CHAPTER VI

STYLES OF FISHING AND TACKLE

My first experience with dry-fly fishing occurred a long while ago. It must have been more than twenty years since I made a visit to Henryville, in Pennsylvania, and fished in the streams there, which were then full of brown trout, but contained very few brook trout. In those days I was considered a good brook trout fisherman, but had not had much experience with brown trout.

A couple of days with very indifferent success made it evident that the usual methods for brook trout fishing and fishing down-stream with a wet fly would not catch many of these brown trout. There were a number of trout in the brook, and many rising, and yet I failed to catch any considerable number. It seemed plain that the difficulty was with the flies and the method of fishing, and that some other means would have to be adopted to catch many of these fish.

When I returned from town the following

week with a large assortment of dry flies and dry-fly leaders, I felt that this must be the way to fish for these fish, as I had read of dry-fly fishing in England but had never practised it myself, and knew nothing whatever about it except from these descriptions. This was before the use of the dry fly was commonly known here. My attempts at dry-fly fishing began on a small branch of the stream called The Paradise. No success in landing any trout on a dry fly attended these efforts until lunch time, when I sat down opposite to a pool which was a long run along a bank, and quietly ate lunch under a tree, watching five or six trout rise continually over against the bank. This was soon too much for me, and I got up and placed the fly as nicely as possible over these fish. They let the fly go by and made no attempt to take it, but would continually rise and take natural flies on the water. I sat down and continued my lunch and thought about this curious fact—that these fish were feeding and yet would not take an artificial fly. It seemed as if it must be the leader which was causing the trouble,

as the natural flies, of course, had nothing attached to them. I happened to have one or two small rubber bands in my pocket. Taking two or three of the flies which had been used in the morning, and putting the rubber band across the fingers, I snapped the flies out on the water where the fish were rising. Each fly as it floated down over the trout was at once taken below the surface by a fish, and not a single fly went by the rising trout. Similar flies were then cast over these fish and failed to get a single rise. This proved conclusively that the leader was the real source of the difficulty, and from that time to this I have not changed my opinion. It is the necessity of using a leader which makes dry-fly fishing difficult.

This year an account appeared of an English fisherman who had spent a day with Mr. Hallford a number of years ago. They had very poor luck in raising fish, and finally came to a bridge below which a number of trout were rising. Mr. Hallford threw some old flies on the water and they were at once taken by the trout, whereas the same pattern of

flies cast from the rod were refused. He reached the same conclusion that I had on my first day's dry-fly fishing—that the leader was the greatest source of difficulty to the fisherman. Any one can try this same experiment when he has found trout hard to raise, and I am sure he will always find similar results.

Anglers take it for granted that if they have a good leader and a fly which they believe is the right one for the day and water they are fishing, this is all they can do, and the results of the day are governed by luck or skill. It should be pointed out that this is not necessarily the case, and that in wading a stream all kinds of water cannot be fished with the same kind of tackle and be expected to yield the best results. Slowly the conclusion has been reached that tackle must be modified to suit the water and location of the fish. The number of trout which should be caught cannot be taken if the same tackle is used for all kinds of water during the day.

It has always been a matter of interest to find out why so very few fish were taken in

large, clear, still pools later in the season when it was evident that they were there, and in fact could be easily seen. They seemed perfectly safe from me as long as they stayed in the big pools; for years I caught very few fish in these places in clear water.

It was not until the large, clear pools of the Neversink near my camp gave the opportunity that I really seriously studied this problem in trout fishing. Before that I simply fished along the streams, and if no fish were caught in a large pool it made no difference, as there were plenty more places to fish, and I passed on. However, seeing the fish in these large pools excited interest, and I resolved to see if they could not be taken by some means or other.

Like most anglers I used an eight-foot or nine-foot leader, but always had a fine tapered piece of gut at the small end, and made this as light as possible but still able to hold the fish. Such a leader is all right for ordinary stream fishing, but will not take many trout in large, still pools, except at the head or just where the water runs in.

The first idea was to use a very fine wire-drawn leader, about ten feet in length, but it was soon evident that this cast badly, and the trout still moved away when the fly struck the water. Later on the fine wire-drawn leader was added to the nine-foot regular leader, making this eighteen or twenty feet long. To my surprise this cast much better than the fine leader alone, but it could not be cast at a short distance as it did not carry enough energy in the line and leader to propel it forward. It could not be cast less than about fifty feet, and began to work well at sixty feet, and best at sixty-five to seventy feet. At this distance the trout did not seem to move away from the fly as much as before, but flies even as small as No. 18 seemed to scare them still. While some fish were caught on this tackle it did not get the desired results, and the problem was not yet solved.

One day a good-sized natural fly lit on the still water ahead, and I saw it did not scare the trout in the least, but a large one came up quickly and took it. Why could I not use a large fly and make it alight as lightly as the

ordinary fly? I tried those in my box, but they did not behave as desired. When they struck the water the trout still moved away.

That night some flies were tied with this idea in view—to make them as light as possible, and make them fall on as large an area of water as could be done so that the splash or disturbance would be at a minimum, more like the alighting of a natural insect, which uses its wings in coming to rest easily on the water. Hackles were used and tied on very small hooks, No. 16. No body at all was necessary but the hackle wound directly on the hook itself. These flies were made from a half inch to one and a half inches in diameter, all on No. 16 hooks. This, of course, made a very light fly. When cast with a long, fine leader, they fell upon the water as lightly as natural insects, and to my delight not even the largest of them would cause the fish to move away. When the trout did not rise at once all that was necessary was to let the fly rest a moment and then pull it slightly. This almost always attracted the trout and he rose.

The next day I visited one of my favorite big pools, where I knew there were plenty of fish, and where I had never taken more than two or three at one time. I wanted to see just what could be done with the new method. The fishing began at the tail and covered all the water where there was any possibility of fish, plenty of time being taken, as I was all alone and had all day. The result was a complete surprise. In all, in this one pool fifty-two trout were caught, running from eight inches to fifteen inches in length. All but one, which was cooked for lunch, were returned to the water, as this was not an effort to get trout but an experiment. Probably by far the larger number of fish in this pool were caught that day, and very few escaped healthful exercise. Since then twenty fish, one after another, have often been taken from one pool in this way, in a vain attempt to take the old big one.

Putting these fish back does not injure them at all, and to prove this a small punch like those used for marking baby chicken feet has been carried, a hole punched in the dorsal

fin or the small adipose fin of the fish, which is then returned to the water. These fish are often caught several times in a season, and frequently the following season. If the fish are carefully handled they are not harmed in the least.

The tackle, as described above, is entirely unsuitable for fishing rapid water or pockets, and the question was how to be able to fish both ways. The plan finally adopted was to carry the fine leader on my hat and tie it to the regular nine-foot leader when a big pool was reached. When this had been fished out and the rapids reached, the fine leader was removed, and the fly again put on the nine-foot leader. Another way is to remove the nine-foot leader from the line and put on a long eighteen-foot leader. This is very conveniently done if a small loop of gut is spliced to the end of the line—then no knots have to be tied. It is well worth while to take this trouble, as the change in the style of fishing is a great rest and adds much to the variety of the day's sport.

The fishing of rapids and pockets can be

THE AUTHOR FISHING LEROY'S FALLS ON THE NEVERSINK.

done in two entirely different styles. I use both at times, and get about equally good results by either method. The style Mr. La Branche prefers, and at which he is a past master, is to use a nine-foot leader and rather heavy line and make short casts from ten to thirty feet, checking the rod on the forward cast at an angle of about forty-five degrees from the horizontal. The line shoots out forward in the air, and as the fly nears the water he raises the tip of the rod slightly and draws the fly so that it will strike the water in advance of the leader; in fact he often keeps the leader out of the water altogether. By this means the fly often makes several skips on the water before it comes to rest. This, of course, makes little explosions of light below the surface, and attracts the fish's attention. He has named this the "Bump" cast. This style of cast requires a leader of about .008 diameter at the fine end or it will not drive properly and lie down straight enough for this style of cast.

The following instance shows the great value of the cast.

I was coming along the stream at Mr. Roof's one day and met some guests, all of whom had been fishing a pool called The Shook Rocks, which is always full of fish. It was about noon and the sun was very bright. They had fished the pool carefully, with both wet fly and dry fly, and had not succeeded in taking any trout. They asked whether trout would rise at that time of day. I replied that the trout probably would not rise the way they had been fishing, but if the pool were fished with a bump cast at the right point I thought it very likely that trout could be caught. They asked me to show them how it could be done. The place was very favorable for this type of fishing because it was possible to stand on a flat rock several feet above the water. The fly was made to skip along the top of the water over a point in the pool where there were a number of rocks which were good hiding-places for fish. The result was instantaneous. A trout came out from under the rocks and took the fly and I landed four or five in a little while. My attempts to teach my friends how to make this

cast were unsuccessful because they were unable to make the fly work in this way, as it requires a great amount of practice and a rod, line and leader particularly adapted for this form of fishing.

If such a leader mentioned above is laid out flat on the water over a fish it is likely to scare him and you have not as good a chance of catching him as with a fine leader. Mr. La Branche therefore casts across the stream wherever possible and lets the fly come down-stream ahead of the leader, as we do in dry-fly salmon fishing. This style of cast works extremely well when you can make it, but such a leader is not the best for all types of fishing.

With a nine-foot leader and about two or three feet of gut of .005 to .006 diameter at the fine end I can make better curl casts, even in swift water, than with a heavier leader. Such a leader does not allow the fly to strike the water nearly so hard as the heavier leader, and if the cast is not quite perfect it is more likely to raise fish, whereas with Mr. La Branche's style of fishing the cast must be

practically perfect if shy trout in clear water are to be taken. My leader is not as strong as his but it adds greatly to the pleasure of fishing to use this light tackle, as I know the fish has a good chance to escape if the tip of the rod is not kept up high enough. After all, most of the trout in our streams are small fish and have no real chance of escape on strong tackle; in fact, if we choose we can throw them right out on the bank and we only play them for our own amusement. This may easily be done on small fish by the novice. I once taught a French count to fish with a fly near Contrexiville in France. The following year I asked how he had progressed with his fishing. He replied: "It is great sport, but the trees, the trees they are the great trouble, all the trout they fly up in the trees. But I have fixed all that now, I have my man come along with the ladder." This is all a game of bluff. With really fine tackle you cannot raise trout from the water and you must have genuine skill to catch even small fish and not break the leader.

When a pound or a two-pound trout is taken

on this fine gut which breaks at a pound or a pound and a quarter, or even less, I feel that a really skilful piece of fishing has been done in a sportsmanlike way and it gives a real thrill.

We now come to the much disputed subject of the exact imitation of the natural insects by the pattern of the flies. Most authors insist on the importance of this exact imitation and most anglers attribute their success or ill luck to the closeness of these resemblances. While it cannot be denied that a fly made as closely as possible in the imitation of an insect will catch many trout I have rarely found that the imitation must be in the fly pattern and design alone. The appearance of the fly to the trout consists of three factors and the second is by far the most important.

The first is the pattern and color and size of the fly.

The second is the action of the fly in alighting on the water and while it remains floating.

The third is where the fly falls with reference to the position of the fish.

If the fly is of the proper size for the trout at the time the fishing is being done, as I

pointed out elsewhere, its color and pattern are not of any great importance. Dark colors are more visible to the trout from below than light colors, and, therefore, take more fish under most conditions and are more generally used. They are often, however, more difficult to see on the water than the lighter flies. This is the reason for my favorite design of fly which I call the Bi-Visible which consists of a Palmer-tied brown hackle on the head of which is wound a small wisp of white hackle. The white resting against the brown becomes very visible in most lights to the angler; on the other hand, the trout sees the brown hackle from below better than any other color used. This fly is by far the best of any I have yet seen for all species of trout and it is based on a sound physical principle.

Flies may be tied in any form from a Palmer hackle to a winged fly or a spent gnat without any effect upon the number of fish raised, provided the fly is cast and floated properly on the water and the right size used. I say this advisedly because very few anglers realize when the fly is properly cast or floated.

Recently fishing with a friend on a large pool where the water ran along a ledge of rocks this was demonstrated. He had raised one fish among those feeding but could not make any more come up although fishing for some time. He asked me to try and see what I could do. I made a cast and as the fly floated by I remarked: "That is no good; the leader is slightly pulling the fly and no scarey trout would take it." This was because of the current. The cast was quite a difficult one to make, requiring a considerable amount of loose leader in the water near the fly, so that when the fly ran past the rocks the slack would pay out and would not pull the fly. After two or three attempts I got the cast just right and told my friend that the fish ought to rise now.

As the fly passed over the right spot the trout came up and was taken. The year before three friends were fishing with me in the same pool. They all had a try at the rising fish in an eddy near the rock and none of them hooked any. The fly did not float at the proper point where the fish were feeding, without a slight pull. They discussed at lunch

whether it was possible to take these fish in the eddy. I told them it could be done but that the cast was an extremely difficult one and it would have to be made correctly the first time, as these fish were very wary.

A leader with about four feet of very fine gut near the fly was arranged, and the cast extended at another point in the pool so that it was working just right. The fly was then placed at the edge of the eddy with sufficient slack leader so that the fly could float freely around the little whirlpool and not alarm the fish. On the first cast a good trout was hooked which proved to weigh just under two pounds. After a couple more casts another one weighing about one and a half pounds was secured. These trout were constantly on the watch for surface insects dropping off the rocks into the stream collecting in this little whirlpool. They were very quick to notice anything unusual in the motion of the flies on the surface and were very easily alarmed by anything out of the ordinary. I had fished this pool several seasons before I was able to make any cast to take these trout in this difficult position.

Flies just resting on the surface of the water on their hackles depress the surface by their weight at the point where the hackles touch. These depressions act as lenses when seen from below by the trout and these minute lenses act as light condensers and form brilliant light spots in the vision of the fish when seen from below. When the fly lights on the water and these lenses are first formed by the depression of the surface a brilliant light flash is sent out in all directions and it is this light flash which gives notice to the trout of the arrival of an insect on the surface. I have often purposely cast a fly back of the tail of a trout which I could see resting on the ledge in a pool near the bottom. The light flash of the fly is carried through the water and reflected on the stones on the bottom, within the vision of the trout. He notices this and turns around to see what caused it and is very likely to take the fly with a rush. This is an excellent way to catch a very scarey fish, because the trout is coming toward the fly from the direction in which there is no leader to frighten him, the leader

itself being hidden from his vision by the fly.

When a large trout lying in fairly shallow water is seen, it is best always to try to cast the fly back of his tail, with the idea in view that he will then turn around and take the fly and not see the leader. If one or two casts of this kind are not successful, it is then a good plan to put the fly farther up-stream and nearer his head, then to pass the trout and put the fly on the shady side so that the leader does not lie directly over him. It will be found that many difficult trout will be taken in this way, which would have been frightened by placing the fly directly in front of them at the first cast.

The character of the light spots seen by the fish from the impression of the hackles will, of course, vary with the light from above. The appearance is quite different when the light is directly overhead from what it is with the light on one side, and the appearance in sunlight is, of course, very different from that on a cloudy day, or in the evening.

I have carefully observed all these phe-

nomena on the surface of a tank, which was made with a window below, through which one could look up and see what the fly looked like to the fish. These experiments are fully described and illustrated in my book on "Secrets of the Salmon."

When a natural insect alights on the water it makes light flashes exactly similar to those made by the artificial fly when the fly is properly handled. It is the skill with which the fisherman imitates these light flashes of natural insects which determines the number of trout he will catch. I therefore regard the manipulation of the fly on the surface as more important for successful trout fishing than the exact imitation of the insect himself by the design and color of the fly.

This will not commend itself to the "get-the-trout-quick" fisherman, because one can buy flies imitating natural insects in the tackle store, while the other method can only be learned by years of study and requires a high degree of skill and dexterity.

Trout can be caught with almost any kind of fly if it is of the proper size. Hackles are

much more durable than wings, and do not whirl around and tangle up very fine leaders, and are better to use than winged flies. They can be cast repeatedly to many successive fish, only requiring to be rubbed with a handkerchief and oiled again. The best material for drying flies on a stream is what the dentists know as "spunk." It is derived, I believe, from a Japanese seaweed that can be secured from dentist-supply depots in small sheets about one-eighth of an inch thick, which can be pinned on the coat with a safety pin. A fly pressed in the fold of this material is dried in an instant and ready to use as good as new. In late years nearly all my trout-fishing has been done with hackle flies only. After making them with all varieties of feathers it seems evident that the brown hackle is usually the most visible and the best. With these hackle flies the body is of no importance whatever, and therefore, in those I make I do not use any body, but wind the hackle directly on the hook. This method is employed because the fly so constructed is lighter and is not so liable to become water-

soaked. I have these hackle flies in all sizes, from No. 18 up to flies one and a half inch in diameter, and select the proper fly for the particular day and light. It is only very rarely that any other flies would add to the catch.

This is continually being tested every season by alternation between winged and hackle flies every once in a while, and each year I am more persuaded that this is the correct point of view. There is no fly which will catch as many trout as the Bi-Visible fly properly handled.

A recent poll at the Anglers Club in New York showed that other anglers do not agree with me; the favorite flies were the Quill Gordon and the Whirling Dunn. However, this is not my experience.

Since understanding the effect of motion in the visibility of the fly on the fish, I am much more careful just where the fly is cast. I try to make up my mind just where the fish is likely to be, and just where the best place is to attract his attention when the fly hits the water. The fly must, of course, float on the same current which the natural in-

sects of the stream take. If it does not do this it warns the trout, and he suspects something unnatural and is not so likely to be attracted.

Often when fishing with the dry fly upstream a trout will be seen to rise to the fly, and on coming close to it turn away. Most fishermen believe that this is because the fly is not the right color, or the pattern is not like the insects on the water at the time. However, this generally happens from one of two causes; either the fly is too large for the fish, which have been finding insects of smaller size, and it may therefore look strange and unnatural; or the leader is too large or bright, giving too large and alarming light flashes. Whenever a trout is observed to turn away from the fly I immediately put on one of smaller size, usually of the same pattern. If this is not acceptable I take one still smaller until a size is reached to which the fish rises solidly without hesitation. I then know that such a fly is in accordance with what the trout is feeding on at the time. Over and over again I have watched fishermen failing to hook trout,

and often even failing to raise them at all only because their fly was too large for the particular water conditions. As I always fish with very fine leaders the difficulty of the leader showing has largely disappeared in my case.

When there is a big hatch of flies on a stream all of one kind, and the fish are feeding ravenously on them it is often the most successful plan to use a fly of quite a different character from those the fish are taking at the moment. This seems particularly to be the case when there is a heavy hatch of dunns. One day I was fishing with a friend on a good-sized stream when a large hatch of Whirling Dunns appeared. The trout were splashing all over the stream, and yet we were unable to get a single one. We had put on flies as nearly like the flies on the water as possible. Finally I made up my mind to try something as different as possible, but of the same size. Fortunately there were some Greenwells glory in my box. This is a black-winged fly with a gold-ribbed body.

The fly was cast among a number of natural

flies floating on the current. A trout at once came up and took my fly, neglecting the natural flies near by. This occurred all the afternoon until we had all the fish we wanted. It may have been that the black fly was much more visible to the fish than the more transparent natural fly, but I thought it was just because it was quite different though of the same size.

It is a common experience in spring fishing, particularly in May and June, to find great difficulty in getting rising fish to take an artificial fly. Often they are cast over for a great length of time and only rarely, as if by accident, do these fish take the dry fly presented to them, no matter how skilfully.

Last year at Stockbridge on the Test there were seven of us fishing during as fine a rise of trout as ever comes on a trout stream in the evening. Every type of fly was tried and the longest and best leaders used. After three or four hours of constant casting for numbers of rising fish without hooking a single one, the feeling came over me that I must be a poor fisherman for these trout and would turn up

at the Club at the bottom of the list for the day. When we all got together in the Club room late in the evening for a nightcap, it was found that none of the seven supposedly skilled fishermen had taken a single fish. It could not have been lack of skill or poor tackle where so many were involved. It must have been an unusual cause for such a result.

This started a train of thought late into the night and when the probable cause was finally guessed I could scarcely wait for the next evening to verify the idea. Nothing was said about it to any one as it might prove to be useless, but it was decided to try it out thoroughly and pay no attention whatever to the instructions of the keeper as to what kind of fly to use.

The reasoning ran as follows: Trout take wet flies under water which evidently represent water insects or larvæ of insects moving toward the surface to hatch out. They also take dry flies on the surface, representing flies rising, or even dead flies floating on it, but there is another form of insect feeding which is not adequately represented by the flies

fishermen use. This is the insect hatching on the surface of the water where he rests while the case splits at the back and the wings come out and dry off before he is able to fly in the air. It seems evident such an insect must rise from the bottom very rapidly, probably in a few seconds, but must spend a considerable time on the surface before he is able to leave it with dry wings. Therefore, when there is a hatch of this kind, the trout are looking for insects hatching on the surface and not flies on the surface.

While these insects are changing from larvæ into flies at the surface, I had often noticed that the body would be largely below the surface and only the back above. This would make the body in this position particularly visible to the trout as it would be surrounded by the miniscus of water rising to the body above and this would act as a lens and collect light and look very bright from below. It ought, in fact, to be much more visible than a dry fly simply puncturing the surface with stiff hackles.

How were these conditions to be imitated

as closely as possible? Among my flies were a number which seemed adapted to the purpose in view. They ought to be used as wet flies for the body and dry flies for the support of the body just below the surface. In order to do this all the hackles below were cut off the fly and only those above left just under the wings. This left the body bare. Using a fly of this kind, the wings and remaining hackles are held tightly in the fingers and the body which projects outside the fingers is wet with the tongue carefully so that it will sink. Then, holding the body in the fingers, the wings and hackles are oiled, keeping all the oil off the body of the fly. The fly treated in this way and cast properly will float with its wings and hackles at the surface and the body will hang below and be very visible to the trout, making a fair imitation of a hatching insect. The flies prepared were No. 16 hare's ears and some small No. 16 flies with quill bodies.

During the day two fair-sized fish were caught fit to keep, that is, over a pound and a half—one with a dry fly and one with a fly

of this type—but there was no real hatch of insects at the surface as there had been the night before until about seven P. M. when the conditions resembled the previous evening and there was almost a continuous rise of fish. First the regular dry fly was tried with no success and then one of the new style flies was put on, being a cut-down hare's ear. The result was exactly what had been hoped for. This fly did not look in the least like the hatch taking place at the time, but there were only a few casts made when it was fast to a good one. There were four fish rising in the stretch of stream and all of them were raised or hooked and two landed.

We then went up to the big pool below the mill where some good fish were seen the previous evening. One was feeding and the fly carefully placed over him. It took him on the third cast—a fish of two pounds nine ounces. As this fish was being played toward the shore a larger one began rising in the centre of the pool. He looked like a much bigger fish but it was growing too dark to see clearly. The leader and fly were carefully

examined to see that they were in good shape and the cast was made. It was a long cast to the centre and it took several tries to get the fly in the right position for the fish as he was feeding in a small lane in between the weeds, but it finally landed just right and his mouth closed over it with a satisfying suck and the line straightened as he ran toward the mill, about fifty feet away. It was quite a task to stop this large fish in the weeds and bring him back where the keeper was waiting with a large long-handled net like a big crab net. This trout finally came out of the weeds so tired that he lay up on his side and we could see, even in the dim light, that he was one of the big ones of the stream. He came just right and as the man passed the net under him I gave a sigh of satisfaction, feeling that at least one of the big trout that had always fooled me before had at last been caught. Alas, one is never sure of the fish until he is in the basket. As the keeper raised the trout in the air he remarked: "That's a good one, sir." Just then the trout gave one convulsive struggle broke the

net and dropped back into the pool with the leader parted. He was so spent that he lay in the water so dazed that we tried to lift him out with the hoop of the net as the water was too deep to wade in, but he slowly sank and swam out of sight. My friend wrote me he did not think the keeper would live through the winter after all the jokes poked at him by all the men in the village.

It is interesting to know that this fish was taken a little later and weighed five pounds two ounces. It was entered in the Club book by some joker "Disdained by Hewitt." I was perfectly satisfied as we had six fish for the day and a new way of raising them, and the answer to the failure to get any fish on the previous night. This was the last day of the season for me. There was no further chance to try this out again until this spring on the Neversink.

There, conditions for this kind of fishing are not so common but there were three days in which to test it thoroughly. The method adopted was to find rising fish at the tail of pools where they could be seen and at a time

when they were particularly hard to get with a dry fly. One fish was selected and the number of times the dry fly cast for him was counted before he raised. If he was skilfully missed the fly would be changed to the new type which was called a fifty-fifty fly and again the casts counted before the rise. This was tried on a large number of trout, probably thirty in number. The result was an average of ten casts was taken to raise them with the dry fly and only three on the fifty-fifty fly. They took the fifty-fifty in a much more determined manner and were easier to hook.

It seemed that this type of fly was only of great advantage when the trout were taking insects which were hatching on the surface and not much better when they were taking floating flies. Under these circumstances trout seemed to be caught about as readily with the regular dry fly, fished as usual. It is certain, however, the fifty-fifty fly is many times better than any other form when the hatching is on at the surface.

No doubt anglers have often fished flies in

this way unconsciously as many flies are so tied that on some casts the body must float below and the hackle and wings above. I have never heard of this being done intentionally by making the body so that it easily becomes water-soaked and the wings oiled to keep them dry. In the hands of the skilled fisherman and fly tier this method will result in his being able to take these difficult fish which refuse to take an artificial fly when they are rising. Perhaps other anglers will not agree and think this is just visionary. But it is pleasant to fool a few more of these trout who have often made a fool of me.

The next step was to take some pictures of the fifty-fifty fly resting on the water, with the photographic lens placed below so as to see what it looked like to the fish. Looking at these flies closely in the laboratory discloses the fact that only a few which had long tail hairs to hold them up would regularly float with the bodies parallel to the surface of the water. They nearly always stood with the body almost vertical. This does not look like the natural position of the in-

sect. It was necessary to find out how they could be made to float as they should regularly. Evidently the hook was too heavy so this was cut in pieces and weighed until the two halves weighed alike on a fine chemical balance. The centre of balance was found to be near the hook end, about two-thirds the distance from the eye, so of course the flies would not float properly. By adding a small weight to the eye it floated right almost every time. It then seemed evident that the way these hooks should be made was to have the wire tapered, making it larger at the eye end of the hook. After many attempts hooks were made in this way and the patent was applied for for flies of this type.

I have gotten most excellent results from flies tied on these hooks, both here and abroad, and many big fish have been taken on them already. I hope they will be on the market in the spring of 1929 for other anglers and that this will be a real contribution to the dry-fly art and enable skilled fishermen to take many fish they could not raise otherwise.

CHAPTER VII

RODS AND LEADERS

In the foregoing incidents different lengths of leaders have been mentioned, so that it is a good time now to explain why I use so many leaders for various conditions of water. The usual dry-fly fisherman uses a leader of seven to nine feet in length. It is ordinarily about .012 inches to .015 inches at the large end, and .009 inches to .010 inches at the small end. The tackle stores all sell these as dry-fly leaders, and the fishermen regard them as the only correct casts to use. It must be pointed out that a leader which is right for one rod and line may be entirely wrong for another. A very small variation in the taper of the line will make the greatest difference in the way a leader and fly will cast and lay out straight on the water. If the fisherman will cast forward and backward in the air and watch the shape the cast takes in the air in front of him, he will usually notice that there is a decided depression toward the ground in

the straightening line and leader in the air. This occurs usually just where the leader joins the line. This is not an absolute necessity, and should not take place with perfectly balanced tackle. The line and leader should make a straight line in the air when it straightens out. If it does not do so this is due to several possible causes. The rod may be too limber and bend too far down on the forward cast. This throws the depression in the line and this cannot be avoided with a limber rod; such a rod can never make a perfect dry-fly cast. Or the leader may be too light next to the line, or the line may be of wrong weight or taper too much.

In recent years I have been having my rods made much stiffer in the butt and having more of the bend take place in the upper end. This is done in order to make a straighter line in the air. Such a rod will not cast as long a total distance as the rod which bends more toward the butt, but it is much more satisfactory for stream fishing. If the leader is too light at the large end joining the line there may be too much difference in weight between

the leader and line where they are joined together. This can be helped by using a leader with a heavier back end, and often by tying additional light gut on the tippet end. The line itself may be wrong and too heavy for the leader, with too long a taper and too long a straight end beyond the taper.

The requirements for casting the best line for fishing and laying out the kind of fly most likely to take wary trout call for a rod which is stiff and acts quickly at the tip without any double action in the middle part. These requirements are absolutely necessary for the best fishing. Unfortunately a rod of this kind must possess considerable power, and will exert more pull than the light leaders will stand, unless the rod is used in just the right position.

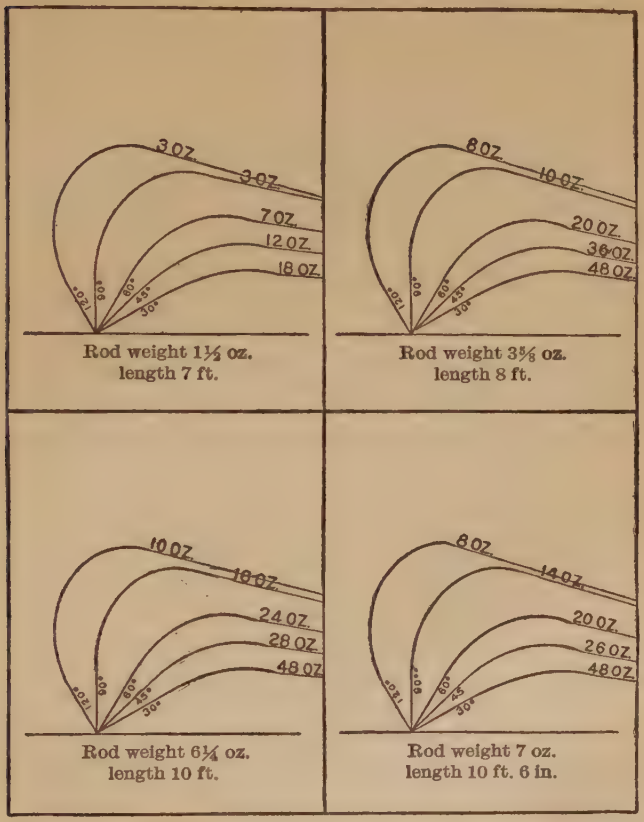
In striking a fish such a rod will easily deliver sufficient power to break the fine tackle which must be used to raise difficult fish in clear water. It is possible, however, with skill and practice to become sufficiently expert so that the fine leaders are rarely parted, and the fly left in the fish. This is one of the most skilful and delightful parts of trout-fishing—

TABLE SHOWING THE SAFE PULL OF RODS IN VARIOUS POSITIONS

Rod		Pull in Ounces—Maximum					Safe Strain	
Length	Weight ounce	Butt back 30°	Butt vertical	Butt forward 60° to horizontal	Butt forward 45° to horizontal	Butt forward 30° to horizontal	Striking butt vertical	Striking butt forward 45° to horizontal
7 feet.....	1½	3	3	7	12	18	10	20
8 feet.....	3⅝	8	10	20	36	48	21	40
10 feet.....	6¼	10	16	24	28	48	24	52
10 feet 6 inches...	7	8	14	20	26	48	24	36

the use of fine tackle and being able to land good-sized fish without breakage. In order to show why this can be accomplished, I have made some tests of different rods I use, and worked out the holding strains with the rods held in different positions. The strain exerted in striking a fish with the rod at forty-five degrees to the horizontal is also given. If striking takes place with the rod nearer the water than this, of course the strain is increased, and the leader may be broken on even a very small fish. If the striking is done at an angle greater than forty-five degrees, of course the strain on the gut is less, as may be seen from the table of rod pulls.

It is evident that when long, straight casts must be made, the rod must stop in its forward motion almost parallel to the water, so that the shooting line can be fed out through the guides from the loose coils held in the left hand. As soon as the shoot is over and the fly alights on the water the rod should be raised to a position at least forty-five degrees from the water, so that if a trout rises the strike will take place against the rod at a



Dry-fly rod for very light leaders, showing rod held in different positions with maximum safe pull on line.

greater angle than forty-five degrees, and therefore put a light strain on the leader.

When fishing is poor and a long time elapses between fish, we are often careless about this, and I have lost many a fine trout by parting my leader with the rod striking too near the water. One can never be too careful always to fish in perfect form, and to make no bad

TABLE OF STRENGTH OF GUT

Diameter of Gut	Breaking Strain in pounds—wet
.005 inches	1 to 1½
.006 inches	2 to 2¼
.008 inches	2½ to 3
.010 inches	3 to 3½
.012 inches	4 to 4½
.014 inches	4½ to 5
.016 inches	6 to 6½
.018 inches	7 to 7½
.020 inches	8 to 8½

or careless casts. We never know the trout that we miss by this neglect of good fishing form—trout are often in such unexpected places.

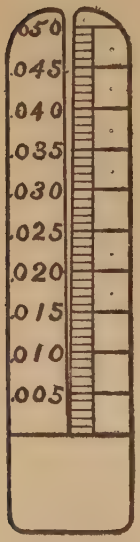
The table for the rods shows the strains that may be exerted on the leaders both in holding the fish and in striking. The above table gives the pull which the leaders of good

quality may be expected to withstand. This table does not represent the gut of exceptional quality which at times is found to be even double as strong as shown, but gut such as the fisherman could be expected to purchase from a good, reliable tackle store.

It must be remembered that flies tied on gut are never reliable. They are generally good when purchased if the attached gut is of the proper size, but if these flies are kept some time the cobbler's wax on the thread and the gut and hook generally becomes oxidized and does not hold. The gut, therefore, pulls out from the hook. When a fly tied on gut has been used and put back in a fly-book, it is usually wet and the hook gets rusty, and the rust decays the gut where it rests against the steel.

The only way to have reliable flies which will last is to get those tied on hooks having small steel eyes, and to tie these flies on the leader itself when they are needed. Such flies, if kept in metal boxes or glass jars, will last any number of years. I have many flies twenty-five years old or more which are just as good as the day they were made. It is

really a great economy to use the eyed flies if you intend going fishing more than once. A very convenient form of gauge which I have made of duralumin in order to make it light and proof against rust can be carried in the fly-book. This is used to ascertain the diameter of lines and of leaders.



Line and leader gauge graduated in .001 inches.

I was fishing last year with my friend, Doctor Rouss, who had just fitted himself out with a new rod and line of the very best make, but he found that it cast badly. The rod was an excellent one and the line about the right weight. The leader was one of my own, carefully gauged, which should have cast well. On measuring the line I found there were six feet of fine level line beyond the taper, next to the leader. With his permission I cut this off and left only about a foot of level line beyond the taper. To his surprise the rod then cast well, and he was able to fish in a way he had never been able to do before. The

line should not be any heavier than necessary to cast well at twenty to thirty feet distance. A line which will cast well at these distances will cast well for fishing farther away. I generally find for dry-fly fishing that an oiled silk line should be about thirty-four thousandths diameter for most rods, and on others as much as thirty-eight or forty thousandths. Trade numbers *C*, *D*, *E* mean little or nothing as they do not represent definite sizes and weights. Heavy lines cast with more power and drive better into the wind, but they hang more heavily in the air when working the dry fly in the water and make a greater disturbance when they alight on the water. In wet-fly fishing down-stream a light line gives better results—but one just heavy enough to drive into the wind. Most anglers use lines which are too light. For brook fishing where much of it is done in swift water and pockets, where the cast is often from ten to twenty feet ahead of the angler, a line with short taper is far superior to those with long taper.

I have made my own lines with only four feet taper, as lines with this short taper were

not for sale at that time. These lines also cast well up to sixty or seventy feet. If long casts of eighty to ninety feet are required, better results would be obtained with longer tapers of ten to twenty feet.

Having some idea of the effect of the rod and the line, we may now come back to the leader.

For fishing pockets in swift water the best tackle is a short leader of seven and a half to eight feet in length, fished in such a way that only the fly is in the water and none of the leader. It is difficult to do this with a leader longer than eight or nine feet, because there is not energy enough in the line and leader to cause it to lay out properly in a short cast of ten or fifteen feet. In fishing a stream I know I generally put on such a leader, which is always ready around my hat, when a long stretch of pockets and swift water is reached. The end next to the fly need not be finer than .008 diameter, if the fishing is to be done with only the fly on the water. In swift pockets trout are very likely to lie at the tail of the pocket and to strike on the lip of the pool, and often make quite a jerk on

the leader, so that unless the angler is very skilful he will break gut of five-thousandths diameter very often. For runs along the bank or ledges a leader of about twelve feet in length, with a very fine end at least two feet long, is best. This length is advisable in order to keep the impact of the line on the water as far away from the fish as possible, and also so that the leader can easily be cast with a curl, so that the fly will come down-stream ahead of the leader. We always fish dry fly up-stream.

For very clear, still pools, and especially for shallow ones, I use a leader twenty to twenty-five feet long, with at least eight to ten feet of very fine gut at the small end. It is very difficult to handle winged flies with this outfit, as they are likely to whirl in the air and tangle the leader. For this reason hackle flies of various sizes are used, as I find them as good as winged flies and not likely to whirl.

The leaders themselves, as pointed out in "The Secrets of the Salmon," are always stained with nitrate of silver by my patented process of soaking and developing with pho-

tographic developer after exposure to light. This fills the outer coating of the leader with small metallic silver particles, which prevent the light refraction and the condenser effect of the cylindrical transparent leaders.

All my friends who have used these leaders are enthusiastic over them, and never want to use any other kind, as they say that other leaders look like strings in water. Messrs. William Mills, of 21 Park Place, New York, are licensed to make leaders of this type, and have them for sale.

It is not an easy matter to get a leader to cast just right. It often takes a considerable time, and several changes of ends, to get it to lay out straight and at the same time cast a curl cast for banks and ledges, but it can be done with a little care and experimenting.

The science of fly-casting has been very carefully described in a number of books, and I am not going to give an elaborate description of how to cast a fly. A few suggestions, however, to the person wishing to enjoy fly fishing might be very useful, as I have taught a number of people to cast fairly well.

It is impossible to cast well with a bad rod and an improperly balanced line and leader. No one can cast really well with a bad outfit. The line can, of course, be gotten out in a way and the fish caught, but it cannot be cast properly.

The rod should be fairly stiff and not too limp in the butt or the centre. The line should be of such a weight that it does not overtax the power of the rod, and at the same time will lay out properly—straight in the air. The disadvantage of a limber rod is that it will not cast a sufficiently heavy line to drive the fly into the wind, and the lightest breeze upsets the fisherman's cast. Another trouble with the limber rod is that when the back cast is made the tip bends too far backward and drops the line backward beyond the fisherman, toward the ground, making a loop in it. When the rod is thrown forward this loop is reproduced in the forward cast, and the line will not straighten out.

It is not possible to make a good forward cast after a bad back cast. The position and shape of the back cast determine the front

cast. When one wishes to learn how to cast properly, the first thing to do is to learn how to make a proper back cast, where the line will go out straight behind the fisherman and well above his head. In order to do this the fisherman should turn around and look at the back cast, paying no attention whatever to the forward cast. The forward cast can be made by simply slapping the rod down toward the water. When a good straight back cast has been regularly obtained, then is the time to study the forward cast and get the fly to light properly on the water. Nearly all fishermen throw the rod too far back. I often do it myself. It should be checked at a point a little beyond the vertical and not thrown back to an angle of forty-five or sixty degrees, as is usually the case. If the rod is checked in the right position, the line and fly will be thrown well above the head of the angler, and there will be no danger of hitting the fly on the ground behind, or catching the bushes. When flies hit stones the hook is very likely to break at the barb. This causes the loss of many good fish.

On a perfect forward cast the line and fly should straighten out absolutely straight, well above the water two or three feet or so, and the fly and leader slowly settle down on the water. If the loop of the line strikes the water well ahead of the leader and fly, the cast is not a good one, as this is likely to alarm the fish and divert his attention from the fly. When it is desired to cast into the wind it is necessary that this forward cast should be low and very straight, because the wind does not blow as hard near the water as it does a little above the water, owing to the friction of the wind against the surface. Therefore, to make a good cast into the wind the angler should slap the tip of the rod right down to the water surface in making a forward drive, and not check it three or four feet up, as he does in the usual cast.

It is amazing how far you can drive a fly into the wind casting this way if the line and leader are the right weight for the rod. It is, of course, rather hard work, and soon tires out the arm and the wrist, but it is often necessary or the fisherman will get no sport what-

ever. It is evident that if a rod is stiff the wood in the rod is put under much greater strain than if it is limber, and therefore the rod must be of much higher quality and better made. It is for this reason that cheap fishing-rods are almost invariably limber. If they were made stiff and properly proportioned it would require much better materials than are available for the price. There are many makers now of good rods for fly fishing, both in this country and in Europe, and it is not at all difficult to procure a good rod, although the price however is usually rather high.

As most trout fishing is done at distances of ten to fifty feet the long cast is the exception, and it is not worth sacrificing the shorter distance casts for the sake of these few long casts. I like a rod which casts perfectly from ten to fifty feet. With such an outfit I can usually cast seventy feet if desired, and this is far enough for any trout fishing. For smaller streams an eight-foot rod is much more satisfactory than the longer rod. On very small streams I even use a rod seven feet long. On larger streams of thirty to fifty feet in width,

a nine-foot rod is usually more satisfactory for most people. Where streams are overhung with brush and the casting is difficult, it is very necessary for the fisherman to make what is known as the switch cast, which is made without throwing the line back of the angler. The line is allowed to lie in the water and the rod drawn slowly back until the loop of the line hanging down from the tip of the rod reaches about six inches below the butt of the rod. The rod is then slapped forward so that the tip about touches the water. The loop of the line is thrown into the air and carries the rest of the line and leader forward. A little practice will enable one to make beautiful casts in this way, and it is very easy to cast from twenty to fifty feet with great accuracy.

The best way to retrieve a long cast and get it going properly in the air again is to let it come down-stream until the position for a switch cast is reached with the line hanging lower than the rod and then make a modified switch cast so as to throw the line forward out of the water and retrieve it backward before

the fly hits the surface. In this way a longer run of the fly on the water is possible and a clean pick-up with no danger of a plucking noise when the fly leaves the water.

The unskilful person is very apt to make a splash and alarm the fish, but by carefully drawing the line to the surface this cast can be made just as delicately as the regular forward and backward cast. Every fisherman should perfect this cast so that he will be able to make it when necessary, and if it were used more often we would not see so many flies and leaders in the trees. I once made a trip, years ago, down a swamp at a club, in Long Island, and in places the trees looked almost like Florida moss, with the leaders and flies hanging down—a great commentary on the skill of the members of the club, and a sure indication of the absence of the "switch cast."

In London during July, 1928, an optical instrument maker was showing me how the reflection on a glass case which prevented our seeing within could be removed by looking through a Nicol prism which is rotated before

the eye until the beam of polarized light is in the proper relation. The glare then completely disappears. He suggested that this would also be true of the glare on water. I carried one of these small prisms to the River Dee and was looking out over a stretch of water to see if I could find some salmon in a good position for dry-fly fishing. There was a sheen on the water as well as ripples which made it absolutely impossible to distinguish anything. The Nicol prism rotated to the right position made the bottom perfectly visible and I located four salmon readily. The gillie said that they could not be seen, but when he looked through the prism and saw them his only remark was: "I'll be damned." I could scarcely get the prism away from him all day. This very useful little device is about five-eighths of an inch in diameter and one and one-fourth inches long, and costs about $6.00 in London. I have not seen them for sale separate from large instruments here. They are made of a crystal of Iceland spar. Small crystals are easily obtained, but large ones are rare and expensive, so that it is not prac-

tical to use them in telescopes or opera-glasses. although I have an opera-glass fitted with them which gives better vision than the single prism.

CHAPTER VIII

STOCKING

STOCKING streams with trout is a necessity in modern times because of the excessive fishing going on almost everywhere. In America the States nearly all have hatcheries, and distribute fish to the streams in various ways. I, myself, had a hatchery at my father's farm in Ringwood, New Jersey, for a number of years, and was able to note the effect of different kinds of stocking.

Trout for stocking are all raised from eggs taken from fish ready to spawn, and cared for in a hatchery. The eggs begin to form in the body cavity of female trout soon after spawning has taken place. I have noticed eggs in trout as large as large pinheads, in April, whereas in other fish the eggs still remain very small. Eggs increase rapidly in size in September and October, and in New York, New England, and New Jersey the spawning time is from the middle of October to the middle of November. The exact date

depends somewhat on the temperature and the season. Brook trout prefer to spawn in small spring brooks on sand or fine gravel in fairly shallow water. This gives the fry a good chance for development when they are hatched, as the larger fish leave these small streams and spend the winter in deeper water. Brown trout, on the other hand, often spawn in the larger streams, sometimes in one or two feet of water. Fry, under these conditions, find protection under stones and in the shallows of the stream. Trout eggs require from 70 to 130 days to hatch, depending on the water temperature. The fry are about a month in absorbing the egg-sack adhering to the body before they can swim freely in search of food. They feed on plankton and small insects and larvæ of various sorts. At the end of the first year the trout may be from three inches to six in length, depending on the character of the individual fish and the food supply.

In England trout develop much faster than here because they have more food and can eat all during the year. Trout do not eat in this country after the water gets below thirty-

four degrees Fahr. In our own hatchery in Ringwood, New Jersey, we tried some very interesting experiments on the growth of trout. We made a series of screens with three-sixteenths diameter steel bars, spaced equally apart for each screen. These screens were arranged in series, the space in each screen being ten-thousandths larger than the preceding screen. The screens were each placed at the bottom of a box about one foot long and six inches wide, and six inches deep. Each box was floated in a small tub of water. Fry were dipped out and put in the box with the screen, and a cover placed over it. The fish, of course, swam toward the light coming up from below, and all that could, passed the bars. In this way we screened the fry into successive sizes, each one ten-thousandths larger than the next, and we kept these fry in separate tanks. This operation was repeated every month. It was soon evident that the fry which were originally larger grew more rapidly than the smaller fry, and by carefully weighing their food we found that they increased more rapidly in size than the smaller

fish with the same food. In other words, they were more efficient food-converting machines. With the large-sized fry it took only three and a half pounds of food to produce one pound of trout, with the small-sized fry about five and a half pounds of food were required, and there were all types between these two limits. We found that it paid better commercially to raise more fry than we intended to keep, and to screen them and secure the fast-growing fish, which proved to be about ten per cent of the whole number. We put the rest of the fry out in the brooks. By this method at the end of the year we had more and larger fish for less expenditure of food and labor than if we had attempted to raise more fish of all the different sizes in the same space. These facts may have some bearing on the sizes of fish we find in streams. Food supply, no doubt, has most to do with it, as I have noticed that brook trout by careful feeding can be grown to weigh a half pound in a single year.

Fish culturists tell me that trout get their full growth in six years, and that they do not

grow any larger after that time. The bones of the head increase in the fish, but the body does not increase proportionately. This is one of the ways in which an old fish can be easily recognized. If fish do not attain a good size by the time they are six years old, they will never do so. In small mountain streams I have noticed big-headed old trout which did not weigh more than a half pound, and which had no doubt attained their full growth, and were already going backward in weight. Some of these small mountain trout were secured, the eggs taken from them in the hatchery, and the fry raised in order to see whether this was a stunted breed of trout, or whether it was lack of opportunity which gave them their small size. These fry grew to weigh one pound in about the same time as the other fish, and were then turned out. Evidently these small mountain fish had been stunted from lack of food and low water during their early growth, and also by the low water in these small streams during the later season.

Trout may be put out in streams any time

after they have absorbed the egg-sack and have begun to take outside food. It is the usual practice, however, to keep fry in the hatchery for a number of months after this period, and to feed them artificial food in order that they may be stronger and better able to look after themselves when planted in the streams. As these fish are very small, the amount of food they consume is not a matter of serious expense, and perhaps this system is advisable, especially as we have considerable freshets in our streams in the spring, which often injure the weaker fry. I have at various times put out smaller fry just after the absorption of the egg-sack, and have been very much surprised to find that the results were just as good as when I put out the larger fry later in the season.

Those putting fry out in the streams are warned generally to put them here and there so as to give them a better chance, and so that large numbers of them would not be exposed to enemies at the same time in one place. I have tried this method, and also tried dumping a whole can at one place, several

thousand being put in at one time. No difference in the success of the results appeared. After dumping in a can of small fry in a brook, I examined the brook carefully every day for a couple of weeks. This particular brook had no trout fry in it when they were put in, so that it was possible to study the distribution carefully. These fry were about one and a quarter inches long when put in. The next day they had travelled two or three hundred yards in both directions, up and down stream. Within an hour of the time they were put in the pool they were so distributed that no enemy would have found many in any one place. In two days these trout were found a half mile below where they were put in, and nearly half a mile above.

All reports agree that the losses in small fry and fingerlings put in streams are very great, probably of the order of 95 to 98 per cent of the fish put out. A kingfisher's stomach, this summer, showed seventeen small fry in it for one meal. Fifty-two kingfishers were trapped about my ponds last season and sixty-one this year. No doubt they

would each have had an equally good meal every day, and perhaps twice a day, and in the one hundred and eighty days would have accounted for 93,600 trout at only ten fish a day apiece.

Experiments of the Canadian Fish Commission on Prince Edward's Island showed that the destructive agencies in the stream itself, or from outside the stream, tested separately or together, reduced the number of trout at the end of the season to about the same point. The summary of the results for four summers is as follows: 1923, loss of trout from the stream in Southwest Ontario 96½ per cent; in 1924, 98 per cent; on Prince Edward's Island in 1925, 73 per cent; 1926, 71 per cent.

It is very evident that small trout must be carefully protected and only larger fish put out under proper conditions if good results are to be obtained from the money expended.

At my camp there are a number of small spring brooks which are stocked every spring. Some years a few fry are put in here and there, and other years dumped in one place. In

examining the stream through the season no difference in the numbers of the fish which survive appears or in their distribution. No doubt hatchery fry which were not thoroughly vigorous and in good condition do not distribute themselves as well through the stream as healthy fish.

It is, however, very necessary that fry be placed in localities suitable for their growth, where they would naturally be found, and where there is proper food and protection for them. It is here that the skill in this kind of stocking comes in. Small spring brooks are often too overgrown to let in enough light for the growth of proper food, and should be trimmed out. They are often too filled up with brush and leaves and trash to give the fish enough room or the water plants a chance to grow. It is absolutely necessary to have water plants and their attendant insect life if the small fry are to grow rapidly and strongly. A very interesting method of stocking which has proved most successful should be mentioned. A spring pond is constructed in such a way that it can be drawn down and com-

pletely cleaned out. About 10,000 fry can be put into a pond of the area of an acre, but no more. These fish should not be fed at all but ought to find their natural food. If the pond is from two to six feet deep, this number of fish will grow rapidly and produce strong trout, capable of looking after themselves, and trout that do well when they reach the main stream. This is almost never the case with hatchery fish, or fish which have been fed in the ponds. They become an easy prey to all kinds of enemies, and do not grow rapidly under natural conditions.

In one of Mr. Monell's ponds, about an acre in extent, we put 10,000 brook trout fry one spring, and drew it down during the summer of the next year. We took 3,450 fish four inches long and over. These were put in a stream which contained no trout. The following year we took large numbers of trout on the fly, weighing from a half pound to a pound and over. Evidently, the stream must have contained an abundance of stored food. Another similar case was just reported to me from the Orchard Lake Club, which accom-

plished about the same results in raising small fish.

They took out about 4,000 well-grown yearlings from a pond of about the same area. I think it safe to estimate that in a suitable area about two-thirds of the fry put in will be destroyed by natural causes, and about one-third will result in hardy fish. It must be remembered that if this procedure is to be followed, year after year, it is absolutely necessary to clean the pond out entirely, and leave no fish in it, because these fish would be a year older than the fry put in, and would eat enormous quantities of them during the course of the year. This occurred in one of Mr. Monell's ponds in the third year. Only 1,200 trout were taken out, two large trout of about one and a half pounds each among them. These had evidently been left there the year before. A number of years ago I persuaded a number of local sportsmen to build a spring pond on the Mongaup River, and for several years they put in fry and drew it down each summer. The result was quite surprising. The fishing in the stream im-

proved at once and became really very good where it had been poor before, although the stream had been stocked each year. Ponds are best drawn down in May or in early June, if possible, as it is found that at this season insects lay their eggs in the exposed mud, and the crop of larvæ is much larger and makes more food for the small fish.

It has been my experience over many years that fish raised in the hatchery to four or five inches in length do not give the fishing results they should when put out in streams and ponds. They certainly produce less than half the number of good fish that the same number of naturally fed fish would do. This is probably because they have not acquired the knack of properly protecting themselves and securing natural food. Or it may be that these hatchery fish have diseases which kill off a large number before they reach adult growth. Whatever the cause may be, we never get really good results with this kind of stocking, such as we would get with fish fed on natural food.

It is almost universally found in our Amer-

ican streams that brown trout are not caught in any large numbers on a fly after they pass fourteen to sixteen inches in length. This is true whether there are large numbers of this larger size fish in the streams or not. As stated elsewhere in the text, this is probably because of the change in the teeth and mouth which enables the older fish to secure small fish for food very easily. This change appears to be complete at about four years of age and from that time on brown trout become mostly bottom and night feeders, subsisting, to a great extent, on other fish. This seems to be true in Great Britain as well as in America. With us our trout are generally four years of age before they reach fourteen to sixteen inches long and under ordinary conditions it is hopeless to expect to ever have good fishing for large fish in many streams. This would be true even if these larger fish were raised in hatcheries and put out in the ordinary way.

However, by taking advantage of the fact that every lot of trout has a small percentage of fish which grow much more rapidly than

the others and by separating these fast-growing fish and feeding them, it is possible to grow fish up to three-quarters of a pound to a pound at two years of age. These fish would have two years before they would become bottom feeders and cannibals and should provide good dry-fly fishing. This experiment is being put into practice at my camp and fine results are expected from it.

This summer in talking with Mr. Lunn, the head keeper at the Houghton Club at Stockbridge on the Test, he stated this system had been in use there for thirty years or more and was the real reason for their wonderful fishing. He told me that they strip from 100,000 to 115,000 eggs and hatch them to the fry stage and sort out the largest fry, keeping only about 3,500, putting out the rest in the stream. After six months the fish are again sorted and only 1,600 retained; that is, they attempt to grow to stocking size only about 1.6 per cent of the number of eggs stripped. They use horsemeat and ground salt-water mussels for food. The streams where these fish are raised furnish a very

great amount of insect food as well. The result is that these fish all exceed one and a half pounds in two years and many of them reach two and a half to three pounds in this time. The stocked fish rise readily to a fly and the whole year's catch of 1,000 fish averages two pounds or over. A little better results will be obtained in England than in America because their fish feed all the year while here there are three or four months when the water is too cold for fish to consume much food or gain in weight. However, it is evident that a system of this kind will provide much larger and stronger fish than any system in use at present.

The experiment of feeding the trout in the hatchery for only one year is being tried. In November of the second year when the trout were about twenty-one months old they averaged nine inches long. Some of them were even ten inches long and weighed about eight ounces. These trout are put in ponds stocked with snails and shrimp, not more than 300 fish being put into the acre, and they are allowed to get their own food for

one year. In this way it is expected they will then weigh from one pound to a pound and a quarter. As the growth of the fish is only a function of the amount of food and its ease of acquisition, it becomes a question of pond area and the successful raising of crustacean and insect life. The amount of this grown on a given area depends on the vegetation largely and having the right breeds of snails, shrimp and insects for the water. Much stocking with a shrimp which will only grow in a limestone water has been done and almost none with shrimp suited to ordinary soft water. I now have a number of varieties of snails which reproduce themselves in enormous quantities and one suitable type of shrimp for soft water. Its Latin name is "Hyalella." Every effort is being used to secure all the different types of snails and shrimp suitable to the soft waters of the Catskill region.

The State of New Jersey for many years has been putting out well-grown fish of catchable size, and has furnished fishing to many anglers. These fish, however, lack all gamey

qualities and are very poor sport. The Fish Commission makes a great mistake in putting out these fish during the fishing season. The stocking wagons are always watched and followed by a crowd of eager boys who catch a large number of these fish within a few days of the time they are put in, by any fair or foul means at their disposal. One of the boys on a stocked stream told me that the State had put in 400 fish, and the boys had caught 370 in twenty-four hours, and he thought that was pretty good fishing. It seems to me that this kind of thing is a great waste of money. If the fish were put in during the closed season just before the spawning season, the fish would have a chance to spawn, and would be used to the water and be scattered before spring, and could then furnish real sport to fishermen, and the boys could learn to fish in a proper and sportsmanlike way. As it is, the license fees of the sportsmen furnish the fish, and the boys get the fun. It seems to me the sportsmen who pay the money ought to be given more consideration.

Owners of trout ponds frequently put in screens to keep the trout from escaping, and these screens are usually of fairly close wire or rods. In our Eastern streams eels come from the sea, small eels two to three inches long, which can get through the screens when they come up in the spring. They grow rapidly in these ponds, feeding on the trout and small minnows, suckers, etc. When they weigh three to five pounds or so, they want to go back to the sea to spawn, and the migration takes place in late September or October. They are prevented from getting out by the trout screens, and therefore accumulate in the ponds in large numbers.

A recent case of this kind occurred at the Orchard Lake Club, where the fishing had grown steadily poorer for a number of years. The real reason was that the pond contained large numbers of big eels, and the hatchery was feeding them on trout. I have found seventeen trout in one eel I speared in our brook. They raised the screens in September and October finally, and let the eels go to the sea. At this season trout will not go down-

stream. They are all heading up-stream to spawn. There ought to be much better fishing in this club in the future.

In feeding trout marked improvements have been lately made which have reduced the cost of the food and at the same time increased the size and vitality of the fish, almost eliminating the great losses from death in hatcheries running on this system. It has been found that certain vitamines are necessary for trout growth as well as for other animal life and food containing these, properly balanced, gives better results than the former liver diet which is now impossible to use on account of the great cost of liver.

Trout must have an adequate supply of fresh animal matter or insect tissue. Nothing else has been found to take the place of this element in their diet. For hatchery purposes this is most cheaply obtained by using sheep plucks ground up. (Note:—Sheep plucks are the heart, liver, lungs, and stomach of the sheep.)

Trout must also have vitamines A, B, and D. These vitamines are best provided by

cod liver oil, and by ground, steamed white beans.

Trout also require some iodine for rapid growth and this is furnished most easily from dried salt-water shrimp.

The diet used is made up as follows: One-third sheep plucks, one-third ground steamed white beans, and one-third ground dry shrimp. To this is mixed about 2 per cent cod liver oil by weight. For small fry a meal made from dry cod livers from which the oil has been extracted has been found to be an excellent food when added to a fresh liver diet. Fish fed in this way grow faster and are stronger than those fed on scraped fresh liver alone. Of course, if a sufficient area and natural food can be provided for trout, this will always produce a finer and more vigorous fish, usually at less than the hatchery cost, but it is very difficult to provide sufficient natural food and the tendency is always to put in too many trout in the given area so that they are not fully fed.

It may very well be found that even the above improved diet is not the best possible

for growing trout rapidly and that further improvement can still be made because when either trout or salmon first go to sea they make much more rapid growth than any hatchery trout.

This last August I had the pleasure of paying a visit to Mr. Boase of St. Andrews, Scotland, and talking with him about his feeding experiments with trout which have extended over many years. He has found that salt-water mussels are much the best trout food and increase the weight of fish more rapidly than anything else. The mussels are boiled five minutes and the meat is taken out and fed to the trout. His results have been most remarkable and should be known to all fish culturists. It will be seen from the table that he has taken a trout of three-quarters of a pound in March and had him weigh four pounds in November of the same year. This growth almost all took place before September 1 because the trout reduced their feeding about that time.

In other words the fish increased their weight about half a pound a month which is

TABLE SHOWING THE WEIGHT AND GROWTH OF TROUT FED EXCLUSIVELY ON MUSSELS

Name	Age in Nov., 1916	March, 1914	Nov., 1914	Dec., 1915	Nov., 1916	Nov., 1917	Nov., 1918
1. Jumbo	6 years	¾	4	7	8	8½	...
2. Blackhead	7 "	1¾	4¼	6	8	...	...
3. Scratchy	7 "	2	5¼	6¼	7⅝	7½	6⅞
4. Knight	6 "	¾	3	4½	6½	6⅞	6⅞
5. Leopard	6 "	¾	4	5¾	6¼	...	...
6. Stirling	6 "	¾	2¼	4½	5¾	...	...
7. Peddois	6 "	¾	2½	4½	5¾	7½	7½
8. Big Spot	5 "	½	2¼	4	5¼	7⅛	7⅝
9. Little Spot	5 "	½	2¼	3¾	5¼	6⅝	6¾
10. Baby	5 "	6 oz.	2¼	3¼	5¼	...	...
11. Harriet	6 "	¾	2½	4	4¾	...	...
12. Pebbly	6 "	¾	2¼	4¾	4½	...	...
13. Squiggler	3 "	...	...	3 oz.	1	...	...
No. of Trout		19	19	15	12		
Total Weight		17½	59½	75¾	72¾ lbs.		
Average Weight		15 oz.	3.1 oz.	5.1 oz.	6.1 oz.		

far beyond any results I have ever heard of. It was shown that it took about five pounds of boiled mussels fed to increase the weight of the trout one pound. All his fish seem to reach their maximum weight in about 6½ years and to go back in condition from then on. He has never had a trout live to over 10½ years and is of the opinion that this is about the maximum age of trout. This agrees with all the other information I have been able to obtain. Last summer he had a six-pound brook trout and a rainbow of about the same size, as well as several varieties of brown trout. This indicates that the mussel diet is good for all the trout species.

If these results can be duplicated here it may open a new era in trout-raising because not only can large fish be easily raised while they are still young enough to take a fly readily but the hatchery space required to do it can be reduced by more than half. I have arranged for a source of supply of mussels for this season and intend to carefully try out this very interesting experiment. The mussels will be salted after being removed from

the shells. The salt will be washed out to a great extent before they are fed to the trout. Should these fish make the growth they do in Scotland they could be put out in the stream the same year late in the season and caught at a weight of two to three pounds. It is very unlikely that such fish would do well in a stream or winter over. They would not be able to get enough food, but their chance of doing so would be much better if they are put out late in the season than in the spring because then they would have a longer time to lose weight before the winter season.

I have found recently that by making microphotographs of the scales and looking at the rings of growth, that the amount of food which the fish have absorbed can be very thoroughly checked up so that it is possible to find out whether a given fish has been amply fed at all times.

In my own ponds I put in a given number of fish for the pond and when they are taken out scales from these fish are examined to see whether they have had sufficient food to make a maximum growth. If not, fewer fish are put

in the succeeding year until the number of pounds of fish per year each pond will produce with the insect life available is determined.

It appears to be very necessary to have some means of checking up the growth of fish. I also use the formula which is in use in England, called the "condition factor." This is obtained by dividing the weight of the fish in pounds by the cube of the length in inches and multiplying by 100,000. Well-fed trout will have a condition factor as high as forty-five or forty-six. Ordinarily well-fed stream trout should have a condition factor of forty to forty-two. Poorly fed fish will have a condition factor of anywhere from thirty to thirty-five. This condition factor must, of course, be checked against the age of the fish which is obtained from reading the scales, knowing that the winter rings are close together and the summer rings wider apart.

An experiment which gives some information about what may be expected from stocking with large brown trout was tried in the Neversink River in the spring of 1929. On

May 18th, thirty-eight brown trout with an aggregate weight of fifty-four pounds, from one and a quarter to two pounds apiece, were put out in the stream. These fish had been spawners in the Willowemoc Hatchery. All were tagged with small aluminum plates in the back fins.

On May 20th the Anglers Club of New York came out for their annual outing and fished the stream in the afternoon. There were twenty-two fishermen in all, each paid $2.00 into a pool and the rule was that the man who caught the fish numbered nearest to his number got the pot. If a man's numbered fish was caught by another, the holder of the number had to put in $2.00 additional. This provision made some fun when one of the members borrowed a fly from another and then went out and caught his numbered fish and cost him $2.00 in addition to the fly.

It rained hard all night and in fact during the whole day so that the river rose over a foot and the conditions were anything but favorable for fly fishing. However, four tagged fish were taken, three in the camp

pool where they were put in and one a mile and a half above where he was put in. During the season twenty-four of these trout were caught, or sixty-two per cent. By far the larger number had moved up-stream, one of them as much as six miles from where he was put in and one was taken a mile and a half below. Quite a number remained where they were put in; some of them to the end of the season. None of the fish caught showed any signs of growth or improvement in condition, they lost their hatchery slime in about six weeks, but they became thin and the last one taken in August was in bad condition and had lost about a quarter of a pound. It is very doubtful if large hatchery fish will ever do well in a stream. It looks as if the ability to secure enough insect food to promote growth had to be acquired early in their lives or they are unable ever to get it. This is certainly the case in England where the streams are much more plentifully supplied with food than here. Large hatchery trout nearly always go back in condition there when put in streams and the owners try to catch

them out during the season as they are usually poor fish the following year.

Judging from this one experiment we can expect that a very large proportion of large brown trout put in a stream will be caught on a fly during the first season within a few miles of where they are put in. It is not probable that they will ever make well-conditioned stream trout and fine trout cannot be secured in this way, but good fishing can be obtained if the fisherman does not care about the condition of the fish he takes. For myself I do not like to catch fish which are not good fish to take home.

We do not know for certain yet just how far the trout can be grown in the hatchery and then continue to make good growth when put out in the streams. At present I am of the opinion that they should not be over eighteen months old, but this opinion must be verified by many control experiments which are now under way. It may be that the best results in the quality of stream fish can only be secured by putting them out when much smaller, perhaps two to three inches long.

Another possibility is raising the trout in ponds on natural food until they reach a good-size and then put them out. It is quite possible that such fish used to still water and pond conditions may not do nearly as well as stream bred fish when they have to live under faster water conditions. This experiment is also under way and these fish will be marked when put out and their growth noted in the swifter water.

Everything observed so far points to the great value of making the natural growing conditions for the small trout in the stream as favorable as possible and taking every advantage of the natural growth in the stream and relying as little as possible on growth made in hatcheries.

Most fishermen are under a very mistaken impression of the number of fish in a stream. I once put out 800 trout of catchable size in three miles and a half of stream. Before putting these fish out there were no trout in the brook. When we came to fish it the water seemed alive with trout, and any one would have thought there were thousands. Now

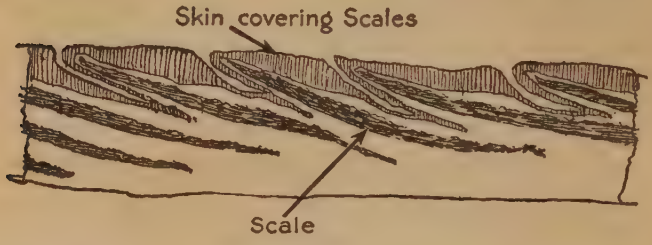
800 trout would make only about thirty days' fishing with various fishermen taking all they could catch, and you can readily see that a brook well stocked as this was could be fished out in a couple of weeks. On my own part of the Neversink I kept account one season, asking all the fishermen I met going out how many fish they had taken. They had taken over 2,800 in three miles of stream, and this had practically depopulated the water. The next year the fishing was very poor, and every one wondered what had become of the trout. A stream which would hold 1,000 fair-sized trout to the mile must be large, and is a very great exception, as it must be realized that it takes three or four years to grow these trout. The ordinary angler does an enormous amount of damage to his further fishing by injuring small trout of about four inches long, which are the fish which are going to make his future fishing for the next few years. It is just as important to be careful with these little fish as it is with the large ones. The only streams I have ever seen where very large numbers of trout are present are those brooks where

the fish run up from a large water area below, or from some lake or large river which is not fished hard. It is, therefore, a tremendous advantage on any trout stream to have a large reservoir for fish below the fishing area. This has been very well illustrated in the Esopus. The great Ashokan dam reservoir has provided a large storage and feeding area for trout, and since the construction of this the fishing has improved enormously, and very much larger numbers of trout are taken from the stream every year now than ever before, although it is fished much harder than it used to be.

All fresh water fish in our streams and rivers have scales. Even eels have scales, but the skin covering them is thicker than that of any ordinary fish. The scale in a trout is really inside the skin in a fold. The membrane covering it, however, is very thin. The drawing above shows the way a scale is disposed in the folds of the skin.

As the number of scales on a fish remains constant during his life it is evident that they must grow to keep him covered and protected.

They grow by successive accretions, which leave marks in the form of rings on the scales. When the feeding is good in the summer season, growth is rapid and the rings wider spaced and more in number. When growth



is slow due to poor feeding in winter, the rings are smaller and closer together, and fewer in number. It is therefore possible to tell the age of a fish by counting the places where the rings are close together, which indicates the winter seasons.

During spawning there is a greater decrease in scale formation. Marks known as spawning rings are left to mark the spawning periods. If scales must grow at the same rate as the fish, it is evident that, if we knew the size of a fish at any age, we could reach a very close approximation of his size at any other

52 rings 3 years and 5 months condition factor 39.6 15.2 rings per year

BROWN TROUT RIVER TEST 16″ LONG, 1 LB. 10 OZ.
CAUGHT JULY 9, 1928

36 rings 2 years and 3 months old condition factor 45.5 16 rings per year

BROWN TROUT 13″ 1 POUND NEVERSINK RIVER
CAUGHT MAY 30, 1928

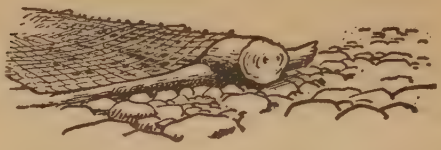
age by measuring the increase in size of the scale. Trout are usually nearly all about the same size at the end of the first year in any given type of water, and therefore if we take their length at this period, and the length of the scale at this time, and proportion this length to the length of the scale under observation, we can get at the length of the adult fish, or his length at any intermediate age.

Dr. Knut Dahl, the fish commissioner of Norway, has worked out a system of measuring trout scales in this way, which might be used to great advantage in this country to learn more about the habits of our trout and their rate of growth. In England much attention is being paid to the study and measurement of trout scales and much valuable information has already been accumulated.

In the first edition it was stated that it was the intention to follow more extensively the reading of trout scales with a view to getting more light on the life history of the fish. This has been done to a considerable extent and the methods of making the microphotographs improved. It would occupy too much space

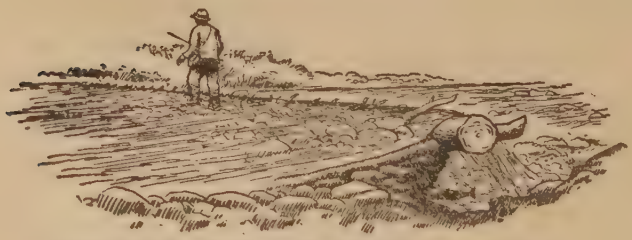
First stage; lengthwise logs laid on stream bed and cross log placed in position.

Application of wire netting in front of log.



Stones and brush placed on wire netting.

Skid sticks placed above log.



Complete Dam, showing undermining and place for trout, also support of cross log when undermined.

to insert all this work in the present edition. It is intended to make another small book about scale-reading and trout-stocking. However, some of the most important matters should be mentioned here. It has been found as expected that there is great variation in the size of the fish of the same age in the same stream. Fish of nine inches or ten inches in length may be three or even four years of age or they may be only two years. This depends on the food and on the individual fish and his inheritance, whether of the fast or slow growing type.

So far as I have been able to ascertain at present trout make from fifteen to sixteen rings per year on their scales if the rings are read parallel to the root of the scale and not at right angles to it. The scales grow more in length than in width to cover the fish, and to accomplish this additional rings are added in the direction lengthwise of the fish which do not make the whole circuit of the scale. No satisfactory agreement of the number of rings with age can be found if the scales are read lengthwise, and there is even much varia-

tion when the scales are read parallel to the root. In the chalk streams of England the distance of the rings from each other in winter and summer shows only small variation due to the fact that fish feed there all winter owing to the milder climate. Here the differences in the width of the winter and summer rings is much more marked and the scales are therefore much easier to interpret.

As a help to any one attempting to make photographs of this kind, it is well to know that they are best made with a dark field "Plankton" condenser which gives much better visibility of the rings. The cleaning of the scales from slime and skin will be found to be quite difficult on account of the small size. If they are digested with a small amount of Trypsin in a four-tenths per cent solution sodium carbonate for about two hours at forty degrees Cent. it will be found that the slime and skin are digested away and a light brushing with dilute ammonia will nearly always give a clean scale. It is best to examine them in the microscope mounted between two slides and not use a cover glass as the

slides can exert enough pressure to keep the scales flat. Glycerine will be found to be the best mounting fluid. In this way good clear pictures can be obtained. It is also well to know that it is not every scale which will give a good reading as many are damaged on the fish. Scales are best taken from the shoulder of the fish just above the medial line. Two pictures are given which illustrate the difference between English and American stream conditions. The readings which I now think right are given. Further study will probably reveal additional facts and perhaps this interpretation may be shown not to be entirely correct. Only a much larger body of evidence will give us complete knowledge.

Every fisherman is familiar with stretches of stream which nearly always hold fish and again with others which rarely show the presence of trout. This problem has interested me for many years, and recently there has been opportunity to study out some of the reasons for this and to experiment on means for converting barren waters into good fishing-places. There are many factors which con-

tribute to make a suitable location for trout. If we can once thoroughly understand them it should not be difficult to change a stream so as to make it hold many more fish than before.

The following list in their relative order of importance seems to cover most of the conditions known at present, assuming that the temperature of the water, its acidity and oxygen content are suitable for trout.

1. Velocity of the water.
2. Hiding-places and shelter.
3. Security from freshets and rolling stones.
4. Abundance of food.

A few years ago I would have placed abundance of food first on the list, but after studying the insect life of the stream it is often found that trout are least abundant where the food is most plentiful. This is one of the discoveries which drew my attention to the other factors on the list.

A Pitot tube metre was made this spring to measure the water velocity at any depth in the stream, and a series of observations

were made at places where trout were most frequently caught and seen and also at places where they were rarely or never present. The following facts developed from this study. Trout cannot stay in water travelling at more than 200 feet per minute. They do stop in water going 150 feet a minute if the bottom is of the right character. They are more frequently found in water below 50 feet a minute.

Where the bottom is composed of small stones the size of an orange or less, the velocity at top and bottom is almost alike and there is no great slowing up of the water at the bottom due to friction. If the stones are the size of a football or larger there is almost no velocity at the bottom for a depth of from two to six inches due to the eddy currents which make the bottom layer almost like still water and the trout can rest there at their ease. There is no velocity just in front of a large stone and the eddy current behind such a stone may even move up-stream.

After considering these facts and looking over my water it was clear that there were

large areas entirely unsuited to hold trout continually and if any use was to be made of this water, beside raising insects, the water conditions must be changed. No matter how good the water may be the trout must have places to hide from their enemies when they are not feeding. They will always occupy a place having a safe retreat. Every fisherman knows places which generally hold good fish and when one is caught another soon takes his place. We can never have many large trout without suitable hiding-places.

Security from freshets applies particularly to gravelly streams with rapid flow and to mountain streams at some distance from their source, where the stones have become rounded and move easily with the water. Trout are often killed by these moving stones and are afraid of them.

It will be noticed by every one that in this type of stream trout are usually most abundant in the rock pools. This is curious because the rock pools produce far less food than the gravelly ripples and gravel pools. Because the bulk of the insect life is in these

places I am certain that the trout stay in the rock pools for protection and not for food, and they forage the ripples at night as is well known. No doubt they would much prefer to stay where the greatest amount of food exists if they could do so safely. At least this was an explanation which seemed satisfactory.

Taking all these facts into consideration the line of reasoning seemed very simple and the remedy obvious if it could be carried out practically. Slower water was necessary. Good hiding-places, security from freshets, and abundant food. If these conditions could be attained the stocking problem would solve itself. The fish would do their own stocking. It is clear that slower water could be obtained by making the stream descend in a series of steps in place of a continuous flow. A series of small low dams would accomplish this and the current between them would be much reduced. These dams could be made to give the best kind of shelter and security from freshets if they could be made so that they would become undermined on the lower side.

But any of the usual forms of dams would very soon be carried away if they were allowed to become undermined.

The first attempt at this was not very successful. A log was placed across the river bedded in each bank and the space in front of the log filled in with brush and stones. The brush was intended to hold the stones in place and to keep them from falling into the undermined space below the log. Two things happened in a year. The stones did drop through into the space below the log and made a hole which eventually caused the carrying away of half the dam. The second thing was that the undermining caused the log to settle as it had no proper support. These defects paved the way for the construction of a really durable and satisfactory dam.

The illustration shows clearly the system adopted. Logs eight or ten inches in diameter and about ten feet long are laid lengthwise with the stream and about six feet apart. On the lower ends of these logs the cross log is placed which of course is bedded in each bank. A strip of wire-netting four-inch mesh and

three-sixteenths, No. 7, wire is fastened to the cross log by means of staples and carried out in front on the bottom logs. This wire-netting is then covered with brush and stones. Four-inch logs are also spiked to the cross log on top and led up-stream and as far as possible bedded in the stones, these logs help to hold the cross log in place and also act as skids for ice and trees as they come down with the freshets.

A dam of this kind will raise the water about two feet in the stream. The cost is roughly a dollar a foot for streams fifty to a hundred feet wide. I might mention here that the wire-netting, galvanized, can be gotten from the American Steel and Wire Co., 30 Church St., New York. It is necessary to have a heavy netting if the dam is to last any time. The weight of the stones and the netting and skid logs will hold this dam in any freshet. If these dams are put in in series the top one will catch the run of stones in the stream and fill up, leaving the lower dams free from stones for a long time. Dams should be placed where the stream bed is wide so as

to have as thin a sheet of water passing over them as possible. Also a wider and better pool will be formed. An area of riffles of 100 to 150 feet should be left between one dam and the next to provide a breeding-place for insects and make food for the pools.

When the dam becomes thoroughly undermined the wire-netting holds the stones like a basket and will not allow them to fall into the space below the log. The undermined space below the log acts as a most perfect hiding-place for fish, especially large ones, and it will hold all the fish of the pool in a big freshet in perfect safety. I have found that large fish migrating down-stream after spawning will winter in these pools and be found there in the spring fishing. These fish otherwise would travel long distances down-stream until they came to pools large enough to afford them safe winter quarters and will not come back up-stream until quite late in the fishing season when the hatches of large insects are out.

Last winter I had only one dam in commission but this spring I caught two nine-

teen-inch trout and six other large trout in this pool above the dam. This was a greater number of large fish than I took in all the rest of my four miles of stream in the season of 1929. This could hardly have been a matter of accident. This autumn twelve dams are completed and it will be interesting to see if large fish are again numerous in these pools next spring.

These dams built according to the foregoing description have fulfilled all the conditions for improving the stream which were discussed at the beginning. It will be of very great interest to watch the results during the next season and see if they are as good as expected. Already one freshet with a six foot rise of water in the river has passed over the dams without doing the slightest damage to them while formerly such a rise of water always caused severe injury to any dams I had made in the river.

Changes in water level in gravelly streams are very destructive to insect life. The larvæ are unable to follow the receding waters and are killed in great numbers by desiccation.

I found large numbers of dead larvæ in the gravel banks. Water levels maintained by means of dams will certainly improve this condition, and should result in a marked increase in insect life. If this takes place this will be another reason to expect a larger number of fish near these dams.

In October, when the drought had caused the river to shrink to about one-third the normal width, an inspection showed that there were as many insects on the stones in the pools as in the narrower parts of the river. This can only mean that two-thirds of the insect life had been killed off by the shrinkage of the width of the stream. This insect life cannot be replaced until next season when the eggs are laid, and there will be a scant food-supply for the fish next spring. In the pool areas where the width of the stream has not been reduced there should be a full supply of insects next spring.

Recently considerable attention has been directed to the relative acidity of trout waters and its effect on the fish and their food. Acidity is measured by chemists according to the

number of free hydrogen and OH ions which are in the water. All water is partly dissociated into these two elements. If the number of hydrogen and OH ions are equal, the water is said to be neutral and the PH number, according to the chemical scale, is 7. If the H ions are in excess the water is acid. This is represented by numbers less than 7, each unit number being ten times the number of H ions of the previous unit number. If the OH ions are in excess, the water is alkaline, and this is represented by numbers in excess of 7 up to 10. It is not necessary here to enter into the complicated chemical physics by which this scale is arrived at. It is now universally known as the "PH Value of Solutions," and is the accurate scientific measure of acidity.

The determination of these PH numbers is most accurately made by electrical devices in the laboratory, but there are color indicators which have been worked out which give the PH values within .2 parts so that these determinations can be made in a minute or so by any one with the proper apparatus.

It has been found by Dr. Knut Dahl, the Norwegian fish commissioner, that trout live best at a PH value of 6 or higher. At 5.6 they become sick, and at 5.5 they die in a short time. He found that peat water often reaches a dangerous value for trout and that limestone filters placed in the water coming to the hatcheries readily made this right.

In Scotland in 1928 a number of tests showed the moorland streams to be usually PH6 to PH6.4, even when they were rather dark colored. In the Tilt Valley, however, there is limestone rock in the upper reaches. The PH value of 7.2 was found in the stream where the water was 6.4 coming from the moor into the stream bed. Evidently running only a short way over limestone bolders increased the PH value. The celebrated river Test which is a chalk stream was found to have a PH value of 7.2 to 7.4 in July of 1928.

It has been found that the fresh water shrimp Gammarus Linnæus will not live well in water with a lower PH value than 7 and never in water lower than 6.8. This is the reason this shrimp does not thrive in the

Neversink or Catskill streams where they have often been planted. The PH value of these streams is from 6.2 to 6.4.

These are several other varieties of shrimps found in Connecticut and Maine and Massachusetts which will live in a PH value of 6. One is the Gammarus Fasciatus, and the other is known as "Hyalella." This variety of shrimp is found in abundance at the hatchery of William H. Rowe, West Buxton, Maine. I have secured this shrimp from him and found they live perfectly in a PH value of 6 to 6.2, although they are much smaller than some other varieties of shrimp. I have not succeeded in getting shrimp for stocking of the Gammarus Fasciatus although I am endeavoring to find a place where these can be obtained.

It will be seen from this that it is most important to secure the right variety of shrimp for the water to be stocked and water should always be tested for the PH value before any stocking is done and it should be known what PH values the particular type of food to be put in will tolerate.

At my camp there was a small spring brook about a quarter of a mile long which ought to have held a large number of small trout. They were often put in there but always disappeared in a short time. A test of the water showed a PH value of 5.8 in the mud in the bottom. It was evident that the decaying vegetation and old wood and swamp muck made this water too acid for the fish to live so it was decided to clean out the whole bed of the stream down to the gravel. When this was done the stream was swept from end to end with coarse stable brooms. Then small log dams were put in to make shallow pools for small trout. The job was completed on Friday evening. On Sunday afternoon I counted over fifty trout which had run up from the main stream in this short time of their own accord because the water was suitable for them and clean. The PH value when tested became 6.4. A large number of trout have grown in this stream this season and this autumn, during the spawning time, over a thousand fish were noticed in this strip of water.

Of all the natural trout food, the fresh water snail is one of the best and most practical and the easiest to grow. There are many varieties of fresh water snails suitable to different types of water. Some of them are much more prolific than others. So far I have tried about twelve varieties. The best kinds are those which have thin shells, almost like paper. The kind known as "African Paper Snail" in Aquaria has proved to be the most prolific and the best food. They seem to lay eggs every ten days or two weeks during summer in a sort of jelly mass attached to the stones or weeds. The number of eggs vary from ten to sixty. They hatch out in two or three weeks, depending on the temperature, and the small snails distribute themselves about the area. They begin breeding when they are less than half grown. Snails feed on almost anything: decayed vegetation or animal matter, algæ, diatoms, and particularly the algæ covering stones everywhere. They always have enough food available for their growth. They are present for the fish to feed on at all times and not at special seasons as

is the case with insects. They have even been seen feeding under a shell of ice. I have not yet secured any swift water snail but have had samples from New Zealand.

About fifty African paper snails were put in a pond of about an acre. The next spring there were several hundred thousand of them all over the bottom. They have been planted in the surrounding brooks and small springs in the neighborhood. They have not established themselves in swift water, and it is doubtful if they can live there. In one small pond in the woods where I had a large number of these snails, they were discovered by a raccoon and completely cleaned out.

A snail diet gives trout a wonderful pink colored flesh of fine flavor.

A small snail hatchery has been made consisting of six small ponds where different varieties of snails are grown for transplanting and stocking. It is hoped that the size of trout may be materially increased if we can furnish them with large quantities of snails and shrimp food. Improved fishing has been reported to me from various places

in England where snails have been introduced and it is hoped the same will be true in this country.

Water plants are just as important as crustacean and insect food so that every variety of water plant which can be found should be tried in each stream until the best flora for the locality is established. It does not follow that the best and most prolific plants already exist in any stream. I have already established a number of new plants strange to the Neversink waters.

It is probably possible to establish many varieties of may flies which are not already present in our streams. I am getting larvæ of may flies for my waters wherever I can find them, and planting them in suitable places. It is too early to say whether they will become established.

CHAPTER IX

FISHING INCIDENTS ON THE STREAM ILLUSTRATING VARIOUS TYPES OF FISHING

It is impossible to overestimate the importance of careful observation of trout and their habits in the stream, both as to where they stay in the water and their methods of taking their natural food. It is only in this way that the angler can understand where a trout is likely to take a fly, and under what conditions, and how the fly should be cast to attract his attention without alarming him.

The habits of trout vary with the hour, the season, and the water conditions, so that the fisherman who is successful one day, and therefore feels that he has mastered the art, is very likely to have a surprise in store shortly afterward when conditions have changed. This change may occur in an hour, or may happen next day or next week, so that the only way to acquire real skill is to charge the memory with a vast accumulation of information about

water, light, food, hiding-places and habits of the fish.

If the particular day on which you are fishing can be properly placed in your memory, you will, no doubt, recollect similar conditions in the past, and know what to do at this particular time. Strangely enough, even the devoted angler often uses stored information far too little.

I had a friend who had fished since boyhood, both in Europe and here, for many years. We both belonged to a trout fishing club which leased a small, clear, cold stream, in which were many brown trout. I had been getting good catches every day and he had been having poor luck. One evening he said he wished he knew how it was done. He had beautiful tackle, tied wonderful flies, and cast a fine line. We arranged to go out together next day, and I promised him that he would get all the fish he wanted. He was very sceptical but delighted to go. We reached the stream about ten o'clock, and he fished the first pool, where we knew there were a number of fair fish. He walked up to the tail of

the pool and began casting up-stream in the deeper water in the centre of the pool with a dry fly. This looked like the best place to fish, as it was, but he did not get a single rise. At the top, in the swift water, he took one small fish, and seemed quite satisfied and turned to me for approval. I told him the pool had not been fished in the best way, and he should have taken three or four fish. At this he seemed greatly surprised and rather hurt. No doubt, I was quite rude, as I often am, but this was the only way to get him to see that there was more to this kind of fishing than merely being able to cast well in likely places. We walked up to the next pool, which was a little larger and had a shallow, smooth tail where the water ran out in a clear, glassy run.

He was about to fish this pool in the same way when I stopped him, over fifty feet from the back end of the pool, to explain that at this season of the year, the end of May, the small trout in these small streams were feeding in the shallow water on the lip of the pool, and that if he walked up there they would

become alarmed and rush into the deeper water and scare the larger fish located in the better feeding-grounds of the pool. The only way to avoid this was to stand back and carefully catch out all the small fish at the back end of the pool, unhook them carefully and throw them in the swift water behind us. In order to do this he must start fairly far away, thirty or forty feet, and fish the lip of the pool very carefully. He was a very skilful fisherman, and took three small fish from the lip of the pool. When no more would rise he fished up a little further. In the centre water of the pool he took three good-sized fish (about ten inches in length) because they had not been alarmed in any way. At the top he got still another fish, and was ready to go on when I asked him why he did not take the large fish under the stump at the top. He wanted to know how I knew there was a larger fish there. I replied that on account of the way the water ran into the pool and passed the stump this was the best feeding-place in the pool as well as the best hiding-place. Therefore, it would be sure to be occupied by

the biggest and strongest fish in the pool, and that this was almost a certainty. He cast several times near the stump without results, and seemed persuaded that I was wrong in my idea. I then took his place and deliberately set to work to create a hatch of flies past the stump, according to Mr. La Branche's idea. It took about thirty good casts, the fly travelling down the current in the usual position of natural flies each time, to attract the attention of the fish and bring him out. He came with a rush when the flies had whetted his appetite sufficiently. This fish was two inches longer than any we had taken, and a very good-sized one for this stream. My friend cast fully as well as I did, and had the same tackle, but he did not understand the habits of the trout in this stream, and in this clear water could never hope to get a large number, while there was really no difficulty in landing thirty or forty in the afternoon, if any one wished to catch that number.

The same fisherman was with me on another trip and got nothing for a whole day. The next day I told him to come with me and

try my way. We were on a larger stream earlier in the season, and the water was fairly high. He was fishing with a dry fly, but had tried a wet fly with no results. At this season, under the weather conditions, the trout were feeding near the bottom, on larvæ, etc., and would not rise to the surface, and fishing there was just a waste of time. All that was necessary to catch them was to fish a wet fly close to the bottom, causing it to move very slowly. To do this a small piece of lead fuse wire was put on, just above each fly and around the head of each fly. It is usually better to use only one fly; quite often the fly can be made to sink and work more evenly by fishing up-stream. It may be urged against this method that it is not good sport, and is more like bait fishing. I can only say in reply that the method of fishing should be adapted to the habits of the fish in the place where the fisherman happens to be, and I consider this the most sportsmanslike and intelligent way to fish, as it gives far more variety to the sport.

The wet fly very often is just as much fun

as a dry fly, as it requires even more skill to operate it properly, but there are very few fishermen who can catch many brown trout with a wet fly in clear water. It is, however, possible to use wet flies even as small as No. 18 at times, with excellent results.

One evening, on the Neversink, we noticed a great rise of trout in the large pool at the Big Bend. They were located where the current runs along the ledge. My son and I fished for about two hours without hooking a single one. We tried all patterns of flies with no results. There were large numbers of small black flies in the air, sometimes even clouds of them, as well as other insects, and even larger flies. Finally, one of these clouds of black flies came around my head, and as I opened my mouth to speak one or two of them got in it, and to my surprise they tasted quite bitter. These were small flying ants, and were bitter with formic acid. (This acid was first distilled from ants.) The fish were evidently taking these small flies on account of this taste, and would not touch anything larger until these insects had all disappeared.

I took some No. 18 flies and cut down the wings to make them about the size of the flying ants, and at once began to get fish. We took a dozen good-sized ones in a little while. Since then these conditions have been repeated a number of times, usually toward the end of May.

It is advisable for all dry-fly fishermen to carry a few very small flies in their fly-books, and use them in case they encounter similar conditions. The pattern does not appear to have any marked influence on the result, but usually the darker flies are better than the lighter ones. Quite often the quill body is more easily seen by the fish than a woolly body. Of course, such small flies are very difficult to see on the water, but as they are cast in the line where the fish are rising, and the rise is noticed about where the fish ought to be, you can quite often hook these fish without seeing them actually take this small fly.

I am very fond of good dry-fly fishing, especially when the trout can be seen to rise and they are of good size. I generally prefer

it to wet-fly fishing. One day, three or four years ago, my son and I were on the Beaverkill when there occurred a hatch of white millers, so thick that they seemed like the petals of apple blossoms blown from the trees. We had to turn up our collars to keep them out of our necks. The whole water was covered, and yet we could not raise a single trout with a dry fly. We soon recognized the difficulty and put on sunken wet flies and immediately caught a couple of fish, as they were feeding on the larvæ on the bottom and the nymphs rising toward the surface. I did not care about wet-fly fishing that day when good dry-fly fishing could be had. We knew another place in the same stream where there were a greater number of larger fish, which would not often bite, so we drove about five miles further on. I felt that those fish which had been taking the nymphs rising in the water would not take flies on the surface until the food coming up from the bottom was gone, then they would take the floating flies. From previous experience this ought to be in about two hours. When we had eaten our

lunch and arrived at the other pools the fish had just begun to break at the surface. My son took one pool and I the other. Before dark he had landed twenty-seven fish, and I caught a few less in the other pool. It was a wonderful chance to fish for rising trout of good size in an ideal location.

It was knowing the habits of these fish, and knowing where a considerable number of trout were located, and what they were likely to do which enabled us to get to this point at just the right moment, and have such a wonderful evening's sport.

A couple of years ago I was visiting Governor Gifford Pinchot at his summer residence at Milford, Pennsylvania. He has a large part of the Sawkill Creek preserved, and the fishing is excellent. The lower parts of the stream are rocky and the glens and falls are beautiful. Brown trout are abundant in the lower water, and we had a fine catch for a morning's fishing. Finally we came to the upper stretches where the stream is gravelly with some larger still pools. As we came to the first of these Pinchot remarked that this held a lot of big

brook trout, but no one ever got any of them with a fly. As we were looking several good fish rose. Pinchot cast over the pool without any results, and asked me if these fish could be caught. I replied that I thought they probably could be easily, but not with the tackle we had been using in the swift water below. We should have to use long fine leaders and very small flies for this type of pool, because I had noticed that these fish were rising to small flies. I sat down on a hassock and arranged the proper tackle for these conditions, a twenty-foot leader, with ten feet of very fine gut at the end, and a No. 18 fly. This was cast on the centre of this pool and allowed to remain perfectly still for some seconds. The leader was then slightly pulled to make the fly move. By leaving the fly still for some time, any alarm felt by the fish from the alighting of the fly and leader on the water would disappear, and they would be attracted by the motion of the fly. This method would be successful in this pool, while it would fail in the Neversink or Peekamoose pools, because the water here was colored with swamp-

water, a reddish-brown tinge—not clear and blue as in the other streams, and brook trout are far more easily caught than brown trout.

In a minute or so I had a one and a half pound brook trout, and landed him at the tail of the pool. After that several more were secured to show that they could readily be taken in this manner.

At Henryville in Pennsylvania there is a small stream joining the main stream, and this being cooler than the main stream good-sized brown trout go up it later in the season, and the larger pools are very likely to hold some good fish. On one trip I had taken several fair fish, and was approaching a pool at the bend where one comes up a steep rise and can look over the rocks at the tail. I peeped over and saw a large trout slowly circling the pool and sucking in flies every little while. It looked as if a cast anywhere near him would surely frighten him, so I tried casting at the right side nearer the tail while he was circling at the head of the pool. The fly lay perfectly still, and I watched the trout slowly coming back down the other side of the pool.

He came across the tail, and as he approached where my fly was floating a little pull was given it to make it look alive. He slowly swam up to it and sucked it in without any undue haste. It was quite difficult to handle this fish in this small water as he ran from one hiding-place to the next and tried to break the fine leader. A gentle strain soon tired him out. This fish was almost two pounds, the best I had ever taken from this very small stream.

My old friend Mr. Dimmock lived in a camp on the Peekamoose stream, about fifteen miles from my camp on the Neversink. One afternoon a pleasant drive brought me over to tea. As I arose to leave at about five o'clock Mr. Dimmock asked me if I would do him a favor. He said that in the thirty years he had lived in this camp no one of his guests had ever taken a trout out of the Blue Hole in clear low water, and he would very much like to see if it could be done. I had my rod and boots in the car, as usual, and we walked up the stream. The Blue Hole is a round pool about seventy feet across and rather deep,

perhaps ten or fifteen feet in the centre. The water enters the pool between two large broken rocks at the top and flows out of the tail at the far corner, the lowest side of the pool being a bar of gravel and small stones. I had fished this place on several occasions previously, and knew perfectly well that no trout could be caught in the ordinary way in clear water, but had worked out a plan which had taken fish the last time I was there.

We stopped about fifty feet from the bar at the lower end, and I explained to Mr. Dimmock that the trout would be frightened by any line and leader if cast in the centre of this clear pool. The plan was, therefore, to cast the line and leader across the bar and let them rest on the stones, with the fly about a foot within the pool in the shallow water near the bar. When the fly had rested there a few seconds it was pulled a little to make it move like a live insect. A trout at once swam up out of the deep water and slowly took the fly. A little steady pull hauled him over the bar, and I unhooked him and threw him into the stream. In this way fifteen fish were taken in

succession without alarming the others. They were not large fish, only about eight to ten inches long, as there are very few large trout in this stream, probably owing to the very cold water and great freshets, but this experience showed how such a pool might be fished under the most difficult conditions. A single cast in the centre of the pool ended the fishing by alarming all the trout, and they promptly went into hiding.

Years ago I was fishing in the Cupsaw Brook with my friend Warren Goddard. He had gone ahead while I remained in the woods to try to get a trout out from under a log. When I came up with him he had just passed a long, still pool with a yellow gravelly bottom which was covered with a light deposit of mud. I asked him if he had seen any fish. He replied that he had not, and did not believe there were any there. I assured him he was quite mistaken in this, as there were two fair-sized fish in this very pool. He wanted to know how I could be sure of this, and I called his attention to two spots on the gravel where fish had been resting and rubbing the

slime off their bellies on the bottom. This is a regular habit with brook trout. One of the places was near an overhanging hassock, and it was evident that the trout must be hiding near this point. I cast over there a few times and one rose and was taken. The other fish was just as easily taken from another hiding-place. He said I must have a nose for fish and could smell where they were, but it was only careful observation of their habits in this kind of stream. It is usually not difficult to tell in small streams about how many fish there are, and make a guess as to their size by watching the fanning places as one walks along. It is not necessary always to see the fish themselves. This applies to brook trout especially; more than to brown trout.

Of course, this observation is not so useful in rocky streams or with bigger fish in larger streams.

One day along Popylopen Creek, a number of good-sized fish had been seen, and I anticipated there were likely to be more. This branch of the creek was a small stream where larger fish run up at times from the bigger

water below. The part where I was fishing was about fifteen feet wide, wandering down through rocky pools. I came to one pool of fair size; it was gravelly, about two feet deep in the centre, with a swift run in the top, with a large boulder partly under water on one side. After fishing the tail of the pool a good look at the deeper water in the centre disclosed a brook trout, about a pound in weight, perfectly motionless. Casting over him for some time in every way I was unable to make him move, as he seemed petrified. Moving up closer and touching him with the tip of the rod did not make him move or pay any attention. This seemed quite out of the ordinary. I wondered what could be the matter, but fortunately guessed what must be happening. The brook trout was evidently at home in this pool and did not want to leave it. He was badly frightened at something and watching it intently. I looked for a snake and could see none, and then it suddenly occurred to me that there must be a large brown trout which had lately come into the pool which the brook trout thought he owned, and that

he was probably under the rock at the head of the pool, and may have been chasing the brook trout out of his favorite hiding-place before I came. If so, it was possible that I might get him. I put on a large fly and looked well at the leader to see that everything was in good shape, and cast several times near the large boulder. The fly was sucked under in the current and was fast to a good-sized fish, which refused to come out from under the rock. I stood still and kept up the strain; after a while he came out and ran around the pool and jumped. I finally landed him, after going under the boulder again, a fine brown trout nearly three pounds, with the large sharp teeth of the cannibal. This was a very large fish for this small stream. If the brook trout had not disclosed the secret by his peculiar action I do not believe I should ever have taken this fish, as he might easily have broken my light tackle by surprise.

If a fisherman is a good sportsman he can play a delightful game of solitaire with himself, of the most interesting kind. I have made a practice of doing this for years on the

stream by keeping score of the number of fish seen rising, and the percentage of these which are raised to the fly and the number hooked. My temper ebbs and flows with the results. When the great day comes when 90 to 95 per cent of the fish I see rising are raised and hooked I feel like the golfer who has beaten the best previous score. Years ago the point was passed where the number or weight of the fish taken counted much with me, as I generally return by far the larger number of fish taken to the stream. The skill of playing the game is the real interest and the real sport. If more fishermen would play the game for sport and return the fish to the stream, we would all have better fishing.

One evening at Henryville, lying in bed with the window open toward the porch, I listened to two brother anglers talking below. One remarked:

"That fellow Hewitt is a damned liar. I don't believe he puts the fish back as he says he does, because he rarely brings back many."

The other replied:

"I thought so for years until yesterday, when I went with him to the Broadhead and watched him put back twenty-six good trout before he put a single one in his basket. I have been thinking this over. Why should we kill all the fish we take on the fly? I am not going to do it in future."

Let us all play the game as a high-class sport, and not as a means of getting food. Most of us, under modern conditions, have enough to eat to-morrow, and the streams can never produce enough trout for the fishermen. You need not be alarmed about fish dying if returned to the water. If they do not bleed they rarely die. I caught 760 trout one season for our hatchery, and only lost two from injury. A few fish for your own use, or for friends, are all right and will not hurt the streams, but no angler ought to take home all he can catch when the fishing is good.

CHAPTER X

FISHING ON THE NEPIGON

The Nepigon is one of the most famous trout rivers in the world, and it certainly lived up to its reputation of being the best river for large brook trout when I fished it many years ago. The river runs from Lake Nepigon to Lake Superior, almost due south. As I remember it, the distance is about forty miles. A considerable part of the channel is occupied by lakes and still water which contain northern pike and are useless for trout fishing. The swift waters of the stream occupy about ten miles in all, in three or four separate stretches. The river has a very large volume of water, as Nepigon Lake is eighty miles long, and about seventy miles wide, and a large drainage area is tributary to it.

I had made a trip there in 1887 and wanted to try it again, as I was sure many more large trout could be caught than I had succeeded in taking on that trip. I had my chance again during the summer of 1891 and selected the

last three weeks of the season because I felt that larger fish were likely to be coming into the river, both from Lake Superior and Lake Nepigon, as the spawning season approached.

On the former trip I had noticed two varieties of trout—one a rather thin and deep fish with very red sides, especially next to the belly, and extremely red fins, and the other variety much rounder and fatter, not so deep, with a rather light, almost bluish coloration on the sides. This latter type of fish came from the large lakes while the red fish lived in the river itself, in swift water. These trout were known to reach a very large size. One is recorded by one of the early survey parties of which a friend of mine was a member, weighing nineteen pounds. The fish was taken near where the river runs out to Lake Superior. This was a regular square-tailed brook trout.

At the Hamilton pool one day an Indian was fishing with a spoon and lead, casting the spoon out by whirling it around his head. The spoon was drawn across the current deep down and attracted the trout. He was secur-

ing his winter supply of smoked fish. He had taken a large number, cleaned them, and cut off the heads, and was preparing to smoke them when I happened to come along. I weighed the largest fish, which was dressed with its head off, on my scales. It weighed exactly eleven pounds. The fish was of the red, river variety, and the Indian told me that these red fish are not caught any larger than this one.

At the Hudson Bay Station at the head of Lake Nepigon, Mr. Anderson, the factor, told us that they took a large number of trout in nets near the spawning beds every autumn, which were used as their winter supply of fish, and were shipped by sleds to the other Hudson Bay stations within reach. They packed them in ice and kept them the year round. I asked him what size the fish averaged. He said he did not know exactly but could get some. We went out to the ice-house, dug out four or five fish, and brought them into the store and weighed them on the store scales. They were cleaned with the heads left on. They weighed from ten to twelve pounds

apiece after being on the ice eleven months. He said the whole catch of many tons ran about this size. There were still about a thousand pounds of these fish in the ice-house.

I spent a couple of days near the spawning-beds in the lake in an endeavor to catch some of these larger trout, but it was too early in the season and we succeeded in getting only one, which weighed eight and three-quarter pounds.

We got a number of fish which the natives call "ling." This fish is similar to a codfish, but has large and sharp teeth and an enormous mouth. I am told by naturalists that these fish are survivals of an early geological period, and exist only in certain lakes. Mr. Anderson told me that these ling reached a very large size, and frequently destroyed their nets when they were placed about the spawning beds. He said they would attain a weight of ninety or a hundred pounds, and he had no doubt they consumed enormous quantities of trout in the lake.

A few years after that I happened to be on a trip to the Grand Discharge at Lake St. John, in Quebec, where I met the superin-

tendent of the hatchery. He told me that he had been putting in very large numbers of ouananiche, or land-locked salmon, in Lake St. John, and although he had put them in of considerable size, the fishing had not improved as he had hoped it would, and he could not understand what became of the fish. Bearing in mind the experience in Lake Nepigon, I told him that it was perhaps possible that ling might exist in Lake St. John, and that they were eating up the ouananiche. He doubted this very much as no ling had ever been seen in the lake, but he put out some large fike nets which he happened to have, and some gill nets. Both batches of nets were torn to pieces within a few days. He then set some deep set-lines, and wrote me a year or so afterward that he had caught a very large number of ling, some of them as large as ninety pounds, and nearly all of them having considerable numbers of big ouananiche in their stomachs. He was persuaded that these ling were the cause of the destruction of the fishing. Since then I understand war has been waged on these fish, and they

have been very much reduced in number. The reason why they are so destructive in these big lakes is that they lie on the bottom and catch the trout when they settle down in the deeper water and are in a logy condition during the winter. I do not believe they get very many trout during the summer months.

There is a lake in Newfoundland called Red Indian Lake, which is about the largest lake on the island, and yet there are almost no fish in this lake. The natives living there told me that they had traditions of giant fish in this lake which destroyed all the other fish. I have no doubt whatever that Red Indian Lake contains a large number of ling. It may be that the poor fishing in Lake Champlain is due to the same cause. I suggested this to Mr. Cheney, the New York State Fish Commissioner, some years ago, but he unfortunately died before he was able to investigate the matter.

During the Nepigon trip I got a very large number of trout—many more than I would have taken if Indians had not been camped along the stream catching their winter sup-

ply of fish. I used to go to one of the camps and tell them not to fish the pools, but to send the squaws with me and that I would catch them the fish. An Indian does not care anything about the sport—all he wants is the fish—so they are only too willing to let me do what they consider hard work. I caught all I could for them, and got a very excellent idea of the run and size of the fish in this river. All I took averaged three and three-quarter pounds. My note-book shows sixty-three trout of over six pounds, and twenty-four of over seven pounds.

One afternoon we were camped at Virgin Falls where the river comes out of Lake Nepigon. I hear they have a mill there now, but in those days it was absolutely wild. Below the falls there were many trout of three, four, and five pounds, but none were visible of any larger size. The aylewives, a small, herring-like fish, were drifting down in schools from the lake. I made up my mind that if the larger trout came down from the lake they would very likely stop and feed on these small fish along the edges where the water began

to get swift above the falls. Fishing along the bank did not succeed in raising a single large fish. The water there was rather deep, about eight to fifteen feet, with large stones and boulders on the bottom.

The best method we had found of getting the large trout had been to use a large fly about No. 00 or No. 000 in size, with a small spinner above it. Perhaps this resembled an aylewife in the water. As I looked out over the smooth run leading to the falls, I became convinced that these large lake fish must be out there taking in the shoals of aylewives, and that my cast did not play properly to take them. No trout appeared on the surface at any time. We had no anchor rope but plenty of leather pack straps. A large stone was procured for an anchor, and about seventy-five feet of pack-straps tied together and thoroughly tested for strength. Two Indians came in the canoe, one in the bow and one in the stern, and I stood in the centre. The Indians were made to keep their paddles in readiness, and we did not get nearer to the falls than the point where we could paddle out against the

current. This was about 150 feet away from the edge. The falls were about a twenty-foot straight drop, and to go over them with this volume of water would surely mean destruction.

We anchored in the centre and the longest cast I could make on either side would not reach the shore. I had brought along a seventeen-ounce fifteen-foot salmon-rod for just such an opportunity. It was fortunate that this was available, as without it these trout could not have been landed. The first few casts failed to raise any fish, and I was a little disappointed until I thought of the depth and volume of the water. These fish would surely be close to the bottom behind the boulders, rising to take the aylewives as they passed over them. I put on a small lead above the fly, cast across the stream, and let the fly sink and swing around with the current. The effect of this method was instantaneous. The line straightened out, and I was fast to a real fish. These trout always fight down-stream, and could not be allowed to go over the falls as there would be no chance of saving them or the

line and tackle. It was just all I could do with a big salmon-rod and heavy salmon leader to stop these fish and keep them from the edge of the falls. I never had as hard a fight with any trout in my life as with these, and in fact with very few salmon. It took some time to get one of these fish up to the boat, and it was extremely difficult to get them in with a net, as we had no gaff.

That afternoon proved to be the greatest trout fishing in my life. Thirteen fish were taken in all, six of them over six pounds each, and one very much larger. I could not weigh them, as the scales had been lost, but measured them with my belt, which I afterward carefully measured. One was twenty-six inches long and twenty inches in girth. According to the well-known formula for the weight of fish, which is described in my "Secrets of the Salmon," the length times the square of the girth divided by 800, he weighed thirteen pounds. I have always found this formula accurate within a very small amount, and the fact that I saw a number of trout of this same size at the Hudson Bay station encourages

me to believe that I actually caught a thirteen-pound trout. This was the regular square-tailed brook trout, and not the lake trout or togue.

At many other places in the river I took six-pound trout, generally with a spinner-fly, but sometimes with regular wet flies close to the surface.

The last day in the season was spent at the first swift water above Lake Superior, as I had an idea that there might be a big run of large fish up from the lake. This proved to be the case, and again a wonderful day resulted. There were six fish of over six pounds taken. I preserved the skin of one of these fish and removed a scale from it recently and photographed it. The picture of this scale is found in the section on trout scales. The picture indicates that the fish had six periods of poor feeding, which means six years in the stream, and the additional six months or so of the season until it was caught. In other words, the fish was probably about six and a half years old.

These fish evidently get this great growth

from the abundant food furnished by the large lakes, especially the enormous quantities of aylewives which very likely are available for food, even in winter to a certain extent, under the ice.

There is no place in America where I have ever heard of such large numbers of very large trout. Some of the other rivers flowing into Lake Superior from the north also have numbers of these fish, but not as many as the Nepigon when I visited it. This is the only place where I have had trout fishing where the trout were as hard to fight as salmon.

One amusing incident happened on the trip. In passing the Indian village composed of small frame-houses I noticed one very small house in the centre, about the size of a large dog-kennel, about six feet high, four feet wide, and six feet long. I asked my man, André, what this was for. He said it was the chief's house. I asked him why the chief had such a small house, to which he replied that the chief had been married three times, and said he would not have any woman marry him again, so he burned up his large house

and built up one which only one person could get into at a time. He said that would keep the women out, and it did. He lived in peace ever afterward. This might be a good suggestion for some other hotly pursued gentlemen of distinguished position.

CHAPTER XI

TROUT FISHING IN ENGLAND IN 1925

Every variety of stream we have in the United States is to be found in the British Isles, but the ones which have been most described have been the chalk streams of the south and east of England.

The Test and the Itchen and Kennet are the most famous representatives of this class of stream. As there are no such streams in the United States a description of the fishing as I have seen it, where it differs from home trout fishing in our own waters, may be of interest.

Although I had fished in these streams many years ago I had in recent years come to think that much of what was written about the difficulty of taking these trout was largely imaginary, and that it could not be that trout really behaved as they were said to do. Last summer, fortunately, a fine opportunity was presented to see for myself, and I am now

quite prepared to believe any of the descriptions I have read.

Mr. Skues very kindly put his stretch of the Itchen at my disposal for two days, which consists of the fine water above Winchester, and I was, fortunately, completely alone on the stream. I say fortunately, not because it would not have been most delightful to have seen Mr. Skues fish this water, but because I wanted to try out my own methods undisturbed by any outside suggestion and see where this fishing differed from ours.

Where the water enters the town the stream is about forty or fifty feet wide, very like a canal with a bank on one side, which keeps the water above the level of the meadows. The stream is of varying depth, apparently from two to six or eight feet, and the bottom is largely covered with weeds, most of which had been newly cut. The current was from one to three miles an hour. Near the railway bridge, about a mile up, there is a little faster water, but no rapids. In the meadows are numerous other canals with similar currents and some cross canals, all controlled by weirs. At first

sight this kind of water would not look attractive to an American trout fisherman. Wandering up from the town, not knowing in the least where to fish or what to do, I kept my eyes open. It was about 10.30 A. M. There is a slight bend, about a quarter of a mile up—some fish appeared to be rising along the further bank.

Pretty soon the back fin of a large trout showed, and then his tail as he took one fly off the water and then another. Knowing that these fish were very scary a fourteen-foot leader had been put on, the lower five feet of which was composed of .005 gut, stained with silver nitrate, as usual. This is done to avoid any light flashes. The fly was a small No. 16 olive, and was cast at the rising fish. At the end of the third cast he ceased rising, and the same result followed attempts at the other two. They had been put down, casting as well as I knew how, and they did not rise again in ten minutes or so. In this water it is no use fishing at random, as these trout rarely take a fly unless they are feeding, and if they are they can be seen to rise, as there usually are insects on the water.

Walking up-stream a little way fish were seen rising at another bend on my side of the stream. The line was cast with a curl, as is customary for salmon, and the fly allowed to come down directly over the spot where the trout had risen. On the second cast the fish took the fly, which was promptly left in his mouth by striking too hard. Anyway, this was some advance—one had been raised. The next fish was also hooked on a few casts on the olive, played a little way, and lost in the weeds. Some progress was being made. The next fish was promptly put down and did not rise again. Another fish let the fly pass over him a number of times and continued to rise at intervals. Changed flies of several patterns finally induced him to take a little dark gray hackle, but he was pricked and did not fasten.

By this time it began to dawn that it was a man's job to catch these fish at all. At home I would have felt confident of landing at least seventy-five per cent of such rises, and would have had a fair catch as the fish were undoubtedly over a pound in weight,

and perhaps larger. The same results followed all attempts up to the railway bridge. Above this is a place with slightly faster water with a bar in the centre and deeper water on each side. Trout were seen rising here. This time a small brown hackle was decided on—a No. 18, as this sets up well. It had begun to rain a little. The lower fish was hooked after a few casts, and proved to be a grayling of about a pound in weight. The next fish seemed very particular about his diet. He let fly after fly go by and finally was tempted by a small fly called the Blue Upright, which is really a small, lightly dressed blue-gray hackle with a quill body. The one used was No. 18 size. This fish played fairly well, and when landed weighed about one and a quarter pounds. All fish were returned to the water as, being alone, there was no use in killing any unless they were large. Two smaller fish were taken from the pool just under a pound, but in every case each fish required study to suit his taste in flies. It was not a case of skilful casting only, as is the case with us, but also seemingly of suiting each individual

fish. Never on these streams, during my visit, which was in the early part of August, was it found that any one fly would suit many successive fish. Each had his own preference.

During the afternoon a few more fish were landed below the pound standard; several hundred good fish were seen in the water, or feeding and not paying the least attention to artificial flies. I went home very tired but feeling that here indeed was the great school for fly fishermen. It seemed as if there were unlimited possibilities of skill and knowledge to be developed to take these rising fish.

The second day began rainy but cleared in the afternoon. Few fish were rising, and none in the morning. In the afternoon some came up to feed, and similar experiences to the day before were encountered, but the day ended with one more fish weighing one and a quarter pounds, and six smaller trout below a pound. No fish are taken from this water below a pound. It would have been very interesting to see what Mr. Skues would have made of these two days. He might easily have made a fine catch. In one place a considerable num-

ber of large trout were seen; one of them I estimated would weigh about four pounds, while two-pound trout were quite numerous.

One could not help feeling that the fishing had not been very skilfully done as I had been unable to hook any large percentage of the rises, but yet my small daily catch was not a disgrace.

The following morning Major Hills, the president of the Fly Fishers' Club, had kindly arranged to meet me at Winchester and drive over to Stockbridge, nine miles to the Houghton Club on the Test. This club has sixteen members and owns nearly all the water they fish. The club is now over one hundred years old, and is the second oldest angling club in the world. They make their headquarters at the Grosvenor Hotel at Stockbridge, a fine example of old Georgian inn.

The Test, at this point, is divided into a large number of small and large streams, which were arranged long years ago to water the meadows which compose the valley at this point. This gives a vast amount of fishing water. The length of the club property along

the valley is perhaps four miles, but the keeper told me there was over thirteen miles of good fishing. The Test is a larger stream than the Itchen. Both have one peculiarity not seen in American rivers. They have no freshets, and the water remains about the same flow the year round. There are almost no small streams entering the river, which is chiefly spring-fed. This is accounted for by the fact that the chalk formation soaks up the rain like a sponge and slowly lets it out in springs.

Just below the Test bridge is a fine house with its level lawn running to the river. The lawn is not over a foot above the river, and the floor of the house is level with the lawn. Glass doors open out on the lawn. Such a situation would be impossible on our streams. The house would be flooded on every freshet.

The keeper told me that the trout he puts out stay about where they are planted, and do not travel much up or down stream as they do here. Trout in this water grow much more rapidly than in America. Fish in the many rearing canals were found to weigh two pounds, and even three pounds in three years.

HOUSE ON THE TEST AT STOCKBRIDGE, SHOWING WATER WITHIN A FOOT OR TWO OF THE FLOOR. PICTURE TAKEN IN AUGUST.

He told me he used to feed them on horse meat, but found the flesh of the trout so fed was white and of poor taste. He found out, however, that sea mussels gave a good growth and a pink flesh. These are obtained from the sea coast a few miles away. About 1,000 fish a year, weighing from one and a half to two and a half pounds, are put out. The club book reveals the fact that the usual catch was about 1,000 fish a year, and the average weight was just over two pounds. Three and four-pound fish are quite common in the catch. Numbers of them were visible in the stream. A fish here twelve inches long will weigh about one and a quarter pounds, and a sixteen-inch fish will weigh three pounds. They are much thicker and heavier than our fish, have smaller heads and are much younger for their weight than American brown trout. This is, perhaps, why they take a fly better.

It is quite probable that most brown trout feed mostly on fish and bottom food after four years of age. This means in our country that the sixteen-inch fish are about the age when they cease to take the fly in the day-

time, while the English fish may have two years, or perhaps three years, before they can become cannibal feeders. The keepers in the Test and Itchen take out the very large fish, when they find them, in any way they can, using nets or snares or any other means, as they believe that these large fish injure the fly fishing. Trout of six pounds or more are rarely taken on the fly. At the Houghton Club the lower limit in size is one and a half pounds, and all fish smaller than this are returned to the water. There is no reason to keep small fish, as most of the trout in the stream are more than one and a half pounds in weight. I have never tasted more delicious trout anywhere in the world. The flesh is a light pink and very delicately flavored. On the first day with Major Hills we went to the lower water and worked up. A few fish were rising and we fished alternately over them with all the flies we had. No one can cast better than Major Hills for these fish, and it was not lack of skill on his part that he did not take a large number.

There must be some trick in their feeding

we do not understand. Any way, we worked all day until 10 P. M., and Major Hills came back with one fish weighing two and a half pounds. I landed two small ones only, but did succeed in raising several good fish, touching them without hooking them. The following day fish were visible in the water where I could fish for them, and I was surprised to find that the fly must pass directly over them, and not two or three inches on either side of them if the trout are to take the fly. This is the same condition which is encountered in dry-fly fishing for salmon. If the fly did not pass directly over the fish he might come and look at it but rarely took it. At last, I saw one fish open his mouth and take the fly but failed to hook him. However, this time he revealed what happened. The distance was only about twelve feet, and kneeling down the light was such that I had a good view of the whole action. The leader near the fly on this occasion was almost straight in the water. When the fish closed his gills and opened his mouth to take the fly, he did it very slowly, and therefore caused a very

slight, slow suction of the water into his mouth. The fly, instead of readily going in, was held back by the straight length of the leader, and either would not reach his mouth or its restrained motion alarmed the trout, and he closed his mouth and forced the fly away. This is evidently the cause of missing trout when they are so leisurely in taking flies. Such failures may be avoided by having loose bends of leader near the fly, which will allow it entire freedom of motion into the fish's mouth. This can be most readily accomplished by having very fine leader next to the fly, and an appreciably different diameter of gut about eighteen inches or two feet above the fly. This will allow the part of the leader next the fly to curl up, where the coarser part remains straight. It appeared as if this would make the best possible tackle under the circumstances. With a cast of this kind arranged another rising fish was soon located. The tackle behaved exactly as expected, the fly passed into the fish's mouth, and he was hooked this time well down in the mouth. The trout was just one and a half pounds

and could be kept. After this experience far more fish were hooked, and the greatest difficulty was to get the proper fly for them to take and to make the cast well enough. A 10-foot 5-ounce tournament rod which I had was far too powerful for this work, as it was too strong in the top for the very fine gut. The 8-foot 3¼-ounce rod was too short to hold up the line properly out of the grass and reeds at the side of the stream. What is needed is a 10-foot rod about 5 ounces or 6 ounces, made stiff in the butt and light in the tip. In other words, made with a steeper taper. Such a rod will not cast as far as the standard tournament rods, but on the other hand it will cast a line straighter in the air, and will strike much more lightly on the thin gut. Such a rod is being made for this kind of fishing, and then it ought only be a matter of skill in casting and laying the line out properly to get a reasonable number of these fish.

The Test trout showed the same predilection for their own particular flies that was noticed on the Itchen. The right fly might be

found for one or two trout together, while others a few hundred feet away would not look at that fly, but wanted something altogether different.

The keeper tells me that the hatches of flies of any one variety extend only a short way along the stream. He has passed nearly all the flies on this stream through their life history in his aquarium, securing the eggs and watching the larvæ until they hatched out into the fly. He seems to know as much about river flies as any naturalist. Some of these larvæ spend as much as three years in the stream before becoming flies.

There is one species of fly on the Test which gave a good rise of trout, but which was never sufficiently abundant on the stream. Mr. Lunn noticed that this fly laid its eggs only on old wood in the water, but that the succeeding day, after noticing these egg lumps, they were usually gone before they had had time to hatch out. He decided to watch and see what marauder was getting the eggs. Nothing appeared during the day so

he watched in the evening, using a flash-light at short intervals. Soon he noticed caddis-bugs climbing up the wooden post from the bottom and eating all the eggs as they came up the post. In order to prevent this he hung boards by wires from the bridges so that the caddis-bugs could not reach the boards as they cannot swim but have to crawl. The boards were soon covered with eggs in all stages of development, and the hatch of flies was greatly increased in all the sections of the stream where these boards were placed. This season he showed me the boards covered with these egg masses and the flies hatching out in considerable quantities. Of course, these rivers have a tremendous advantage over anything we have in this country for producing flies, because they have no heavy freshets and no ice to contend with. There are seven or eight varieties of aquatic plants in the stream which furnish food for the insects and hiding-places for the fish.

The New York State Fish Commission

have found in a recent survey that different types of streams vary between very wide limits in the number of pounds of trout they will support. Rocky ledgy streams are of course the least productive being able to keep about seventy-five pounds of trout to the acre of water. Gravelly sandy streams are much better whereas muddy sandy streams with abundance of water vegetation can maintain as much as 300 pounds of trout to the acre.

When these Test trout are not feeding it is very difficult to see any of them in the water, as they are concealed under the weeds or under the banks. When they come out to feed they place themselves in position in the water at some point where a stream of flies moves on the surface of the water, and a fish feeds at the same point without moving for some time. The water at this point may be either deep or shallow. The trout hold themselves a few inches below the surface and take the flies as they come along the current. Sometimes they remain at one point for a long

while and at other times they feed for only a few moments and then retire to their hiding-places. There seems to be very little regularity in their actions. No doubt, the bulk of the food of these fish consists of larvæ and nymphs taken below the surface. Flies at the surface probably form only a small part of their daily food.

On the second evening that we were fishing there was a good rise of trout for an hour or so, but no one brought home a single fish. This shows how difficult they must be to take, as both Colonel Johnson and Major Hills are thoroughly familiar with the stream. Mr. Lunn, the keeper, pointed out to me that the surface-feeding and free-rising fish were regularly caught every season, and the short-rising or shy fish were therefore left. These fish were taken as spawners each year. This has been going on for over a generation, and must have resulted in a breed of trout much harder to catch than the usual fish. I am certain that this is the case, as the trout on the Gade and the Narr, and in Derbyshire are

much easier to hook on flies than those in the Test and the Itchen. The former rivers are stocked from hatchery fish which have not been fished for. However this may be, the Test and Itchen fish are the most difficult I have seen anywhere in the world, and for that reason the most interesting. The Houghton Club is the finest sporting place I have ever visited.

An opportunity of a day on the Gade in Hampshire was kindly given me by Mr. Franklin Lord, and I also had a chance of two days on the Narr in Norfolk with Sir Neville Jodrell. These streams are of the same general type as the Test and Itchen, with rather slow current and weedy bottom, but the trout are considerably easier to catch, although they are infinitely harder than in any American stream I have seen. Fish could be taken out of these streams fairly well, while I failed to get any number from the Test or Itchen.

Another year, possibly profiting by experience, I hope to develop some ideas which ought

A BEND IN THE TEST NEAR STOCKBRIDGE, TAKEN IN AUGUST.

to make it easier to get more of these difficult fish. It is a great thing to feel this incentive to further study, as the habits of our American trout are so well understood that it is not hard to hook and land by far the larger number of those seen to rise, and many times recently I have succeeded in catching nearly all the rising fish encountered. This always seems to be the only real test of a fisherman—how large a percentage of the fish he sees rising can he catch?

Judged by this standard I am a poor fisherman on the Test and Itchen, but is any one a good fisherman there by this standard? Those who are most familiar with these streams tell me that no one can take the larger number of the fish they see rise in the late season. While the still waters and slow currents of these streams are not as exciting or as beautiful as our faster rocky rivers, the interest in seeing so many large trout rising, and the effort to make them take the fly, far transcends anything I have seen in America. The knowledge of the very great difficulty of the

sport, and the fact that these trout can only be taken with the finest tackle and most skilful casting, makes this fishing more interesting than anything we have. Its reputation the world over is well deserved. No wonder that fishing in these streams commands high prices, even more than many salmon rivers. As for myself, I would rather fish the Test or Itchen for these trout than fish most salmon rivers, as it requires more skill to land these trout on the bank.

Late July, 1929, found me again at Stockbridge on the Test with my friend Hills. The stream was lower than on previous visits and perhaps clearer. Trout were just as abundant as before and were rising freely, but were very hard to take on a dry fly as they had been fished hard for about five months. The conditions were ideal for studying nymph fly fishing, and I availed myself of the opportunity and only rarely used a dry fly. It is not easy in America to secure conditions such that one can see trout take a nymph fly under water, while in the Test the fish being

large and feeding near the surface they are easily observed.

At one point in the stream four trout were seen feeding along a bank which was covered with tall reeds. They were about seventy-five feet or so apart. As I had had the most success with Carters partridge hackle nymphs of various shades I put one of these on and began with the lowest fish. The leader was nine feet long and about .008 inch at the lower end near the fly. Five or six casts put the first fish down and he stopped feeding. All the others behaved in the same way. The fly was cast from two to three feet above the trout, and as nearly in line with him as possible. As the leader is not oiled for two feet above the fly, and is carefully oiled above this the fly sinks rapidly and should be from one to four inches below the surface when it comes to the trout. If he takes it a slight motion of the head or body is all that can be seen, and the gut floating on the surface is often slightly pulled. A small piece of white floss silk tied into one of the leader knots often

makes this motion more visible. The strike must be immediate or the fly will be ejected before you can hook him. If he is frightened he either stops feeding or sinks down or perhaps swims away.

Standing on the bridge a little while later these same trout were seen to be merrily rising again as if nothing had happened. In order to discover whether it was the fly which was wrong or the tackle I put in an additional five-foot piece of gut into the leader cutting it about two feet up from the fly so as to leave the fly and leader near it in precisely the same condition as before. The idea was that perhaps the casting above the trout brought the line and the knot fastening it to the leader too near the fish, and alarmed him just enough to take his attention until the fly had gone by.

With the new tackle the first fish was caught in a few casts, the second was hooked and lost in the weeds. The third was landed, and the fourth hooked and missed. This seemed to show rather conclusively that it was the

tackle and not the fly which was at fault. It was evidently the impact of the line striking the water too near the fish which was the cause of his paying no attention to the fly.

I wish to thank my English friends for their great kindness to me in allowing me to see some of their best trout fishing. Without their aid I could never have had any idea of the wonderful sport they possess, a variety of fishing we can never have in America because we have no streams with these natural conditions.

CHAPTER XII

TROUT FISHING IN THE PYRENEES

In 1891 my sister lived at Pau in the south of France and I visited her during my spring vacation when studying at Berlin University. There was little to interest me at Pau itself, but the trout fishing in the mountains near-by offered great attractions. I used to ride a bicycle every day toward the mountains and fish in the streams which emptied from the hills into the Gave. There were many brown trout in these streams but they were extremely difficult to catch and I did not make much progress with them with a fly.

One day, in fishing one of the smaller streams, I chanced upon a local professional angler sitting on the bank, with a large covered market-basket beside him, eating his lunch. I fell into conversation with him and found that he had in his basket about fifteen brown trout, running from two to three and a half pounds apiece. I asked him how he

had caught any such number of fish. He told me that it was a secret but that he would confide it to me for one Louis d'or.

I arranged to meet him the next morning for the train leaving for the mountains toward a little watering-place in the hills, called Eaux Chaudes. He told me that the best fishing was further up in the hills. He said he would provide all the tackle necessary. When we got out of the train about sixteen miles from Pau, as I remember it, we walked to a large rocky pool in the stream where the water flowed swirling against a large ledge of rocks. It was rather still, with an accumulation of foam and small sticks in the corner. He told me that I would have to follow his instructions exactly or we would not get any fish.

He took out of his overcoat pocket a salt bag containing about two quarts. It was tied up tight at the neck. He untied the bag and took out a handful of sawdust and small maggots which were raised by allowing flies to attack rotten meat. The maggots dropped out of the meat through a wire screen into

sawdust and became clean and more or less odorless in the clean sawdust.

He would throw a handful of these maggots into the swirl at the corner of the rock and I wondered when he was going to fish, as he had made no preparations to set up his rod or tackle. After about fifteen minutes he began putting his rod together; attached to the line was a very fine wire-drawn leader. To the end of this he tied a very small hook, about No. 18 in size, and six inches above this a No. 6 shot was split and squeezed fast to the leader. Above this again was a closed quill with two small sliding pieces on it attached to the leader, so that the quill was about six feet above the hook. The quill was of such a size that the No. 6 shot just balanced the quill and so that the back of the quill was just level with the water. He had painted this red so as to make it a little more visible.

After throwing in another handful of maggots he baited his hook by stringing one maggot through the body and pulling the end of the maggot up over the back end of the hook. He baited another maggot through the

lip so that it would be able to wiggle freely in the water. He then threw another handful of maggots in the water and dropped his maggot with the shot, among the free maggots. It settled down and the float came just level with the water.

In a moment or two we noticed the float began to move, slightly, up and down in the water. Instead of jerking the fish, he raised very slowly, with almost imperceptible pressure lifted the fish close to the top of the water, and then passed the long-handled net under the fish and landed him on the bank without allowing him to struggle at all. He told me that if these fish fought in the water it scared away the rest of the school which had been attracted by the maggots. After a little practice I succeeded in catching a number of these fish in this way and out of this one pool we took nine trout which would average about three pounds apiece. In all, during the day, we got thirty.

While he was taking these fish in this way I fished with a fly in every way I knew how, and also with bait of various kinds, and suc-

ceeded in taking only one small trout about eight inches long.

For taking big brown trout in big pools I am certain that this is the most effective method possible, and perhaps the only way in which these large brown trout can be caught during the daytime in any numbers. I tried this method once in this country and found it worked just as well here as it did in France, but as it lacks all the elements of sport and cannot be made into a sporting way of fishing, I do not think it is worth while to attempt it again.

During this trip I had a very amusing experience which, while it is not altogether trout fishing, may be of some interest. I wanted to get some really good fly fishing and heard that there was a good chance of this at a town called Mauleon in the Basque country near the Spanish frontier further up in the mountains. I got my traps together and journeyed thither. Among my equipment was a good camera which was the cause of all my trouble.

The second day I undertook to photograph an old castle on a spur of the mountain,

and the best point from which to take the picture was in a churchyard. I set up the camera on one of the walks among the tombstones and was just about to snap the shutter when two gendarmes jumped over the wall and arrested me. I naturally supposed that I was trespassing on some forbidden ground.

They took me to the police station, sent to the inn for my suitcase, and then put me in a cell facing on a court, without any examination or any further delay. I waited a little while and then began making a noise by banging on the door. The keeper came and wanted to know what I wanted. I told him that I wanted to know what I was arrested for and what was going to happen to me. They took me into the office of the chief of police and put me through the regular examination, asking me all about my whereabouts for the past year, and a lot of other questions which seemed perfectly irrelevant. It then dawned on me that this might be a political arrest, as I was a student in Berlin at the time.

They sent me back to the cell over night. The next morning I again made all the noise

I could and was taken into the office of the chief. I told him that I must get in touch with the American authorities, either the American consul, Morris Post at Pau, or with Whitelaw Reid, who was the American Minister at Paris, both of whom knew of my trip to the Pyrenees. He then told me that I was a prisoner of the state and not of the local constabulary, and that I could only communicate through a state official. There were no state officials in this small village and the nearest one was located at a village called Saint Palais, about thirty miles distant. He said that no state official would come to this small village for a number of weeks and that if I wished to be released I could pay for a veturino to Saint Palais, where I would be examined by a state officer. This seemed to be the best plan and we started out in a two-horse barouche with one gendarme beside me with a loaded rifle and bayonet, two before me, and one on the box. I appeared to be a very dangerous character.

During the trip the gendarme beside me asked all kinds of questions about the mo-

bilization of the German army in case of war. It then dawned on me that I was supposed to be a German officer and in that case, of course, would know all about the German army and its plans. I told him all he wanted to know, including a complete plan of mobilization by regiments, inventing it all on the spot. He warned me that all this would be used in my trial and that the offense was very serious. My plan involved moving a feint army toward Verdun and advancing the real army through Belgium, which is exactly what happened in the last war. I gathered from his conversation that I was supposed to be an officer of the Ninth Uhlan regiment.

On arriving at Saint Palais I was again taken to a large stone jail and put through a series of Bertillon measurements. They were new at that time and they interested me very much. The doctor who made the examination kept nodding to the officer writing down the results as if everything was going along satisfactorily, until he came to the vaccination marks. I had only three vaccination marks and the German officer I was supposed

to represent had five. This upset their calculations. When they were through they laid out my clothes on the table and gave them in charge of the jailer's wife. She turned around to her husband in a very angry way and said in Gascon dialect, which I understood quite well, "Don't you see that this man is not a German? He has clean linen and silk stockings." She offered to get me good food from the hotel, which of course I accepted.

They took me down through a long stone corridor and locked me up in a dungeon cell having a large oak-studded door such as you see in a play, with large bolts and chains. A small window let in light eight or ten feet up, through close bars. After spending the night there I again tried my old scheme of making a noise. Pretty soon the jailer arrived and wanted to know why I made such a disturbance. I told him that I must get in touch with the government officer. He then confided to me that the government officer had gone to the races and would not be back for a week. This did not suit me at all and I insisted that they communicate with him at

once, as I was an American prince. This seemed to have considerable effect. I told him that my father and my uncle had been mayors of the city of New York and that they were hereditary princes. This evidently galvanized him into action and he began sending some telegrams.

I asked if there were nothing for the prisoners to do. He told me that they had three jobs, one, working on copper kettles, the other making shoes, and the other working in the vegetable garden. I told him that I was "grand" at copper kettles, so I went down and hammered on a large kettle with two Basque murderers, for the day. They were quite amusing, telling me about their experiences, and wanted to know what I had done. The next day I spent in the shoe shop and learned how to make rope-soled peasant shoes, and the third day was passed in the garden with another murderer.

Every night officials would come in and question me. They tried English, French, and German, and questioned me on all sorts of subjects.

On the fourth night the government officer arrived, at about twelve o'clock. He was a gentleman and a man well up to his position. He told me that he had communicated with Whitelaw Reid in Paris and had been assured that he knew all about me and my family and my visit there, and that the government was very sorry that the arrest had happened. He explained that they had been expecting a German spy of the Ninth Uhlan regiment to examine this frontier, where it was planned to build a fort, and the point which I was photographing happened to be the site for gun emplacements.

He said that the officials who had questioned me had reported to him that they could not make out what kind of a person I was. They said that I could not have been born in more than one place at once, as I had reported to them that I was born at Ringwood, Passaic County, New Jersey, in the United States of America, and this was manifestly impossible, to be born in more than one place. During the previous year I had crossed the ocean three times and they said that no man in his

senses would cross the Atlantic three times in one year. They reported that my English was very bad, my German impossible, and my French worse, so they could not make out my nationality.

The officer told me that the feeling in the town ran so high owing to the arrest of a German spy that they would not dare set me at liberty during the daytime, but that a freight train left the town at about three o'clock in the morning and he would have me taken out from the back of the prison and the freight train stop at a siding, and have me put in a box car which would be locked. Thirty miles below, the box car would be opened and I would be allowed to get off on the platform and take the next passenger train wherever I liked, with the formal apology of the French government in my pocket.

They said that they were very sorry the arrest had occurred, but it was all my fault for looking like the German.

On my return to Berlin my fellow-students gave me a Kneipe, on the ground that I had suffered for the Fatherland.

This is the only thing I ever did for Germany and the only thing I ever would do— It will be seen from this experience that trout-fishing can provide adventure as well as sport.